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(57) Abrégé/Abstract:

According to the invention components made of aluminium and aluminium alloys can be welded at temperatures of up to 600 °C using a fluxing agent on the basis of alkali fluorozincate or alkali fluoride/zinc fluoride mixtures. Other fluxing agents, for example on the basis of potassium fluoroaluminate can be used in addition. Alkali fluorozincate fluxing agents, especially potassium and cesium fluorozincate fluxing agents, act not only as a fluxing agent but also improve the surface quality since zinc and alkali fluoroaluminates are deposited on the surface of the components. The invention also relates to new fluxing agents on the basis of alkali metal fluorozincates.

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(54) Title: NEW FLUXING AGENTS

(54) Bezeichnung: NEUE FLUSSMITTEL

(57) Abstract

According to the invention components made of aluminium and aluminium alloys can be welded at temperatures of up to 600 °C using a fluxing agent on the basis of alkali fluorozincate or alkali fluoride/zinc fluoride mixtures. Other fluxing agents, for example on the basis of potassium fluoroaluminate can be used in addition. Alkali fluorozincate fluxing agents, especially potassium and cesium fluorozincate fluxing agents, act not only as a fluxing agent but also improve the surface quality since zinc and alkali fluoroaluminates are deposited on the surface of the components. The invention also relates to new fluxing agents on the basis of alkali metal fluorozincates.

(57) Zusammenfassung

Bauteile aus Aluminium und Aluminiumlegierungen können unter Verwendung eines Flußmittels auf Basis von Alkalifluorzinkat oder Alkalifluorid/Zinkfluorid-Gemischen bei Temperaturen von bis zu 600 °C verlötet werden. Andere Fluxe, beispielsweise auf Basis von Kaliumfluoraluminat, können zusätzlich verwendet werden. Alkalifluorzinkat-Fluxe, insbesondere Kalium- und Cesiumfluorzinkat-Fluxe wirken nicht nur als Flux, sondern bilden auch eine Vergütung der Oberfläche, indem Zink und Alkalifluoraluminate auf der Oberfläche der Bauteile abgeschieden werden. Es werden auch neue Flußmittel auf Basis von Alkalimetallfluorzinkaten beschrieben.

NEW FLUXING AGENTS

The invention relates to new fluxes for brazing aluminum and aluminum alloys, to a brazing method and brazed components.

Structural components (such as the radiator of automobiles or heat exchangers) of parts made from aluminum or aluminum alloys can be produced by brazing (hard soldering) these parts. Advantageously, a flux composed of a fluoroaluminate, which frees the surface of the parts that are to be brazed from oxide adhesions, is used. Fluxes composed of potassium fluoroaluminate are particularly suitable for aluminum or aluminum alloys containing little magnesium. Such a method is disclosed in the British patent 1,438,955. The production of appropriate fluxes is described, for example, by Willenberg, US patent 4,428,920 and Meshri, US patent 5,318,746 as well as by Kawase, US patent 4,579,605.

Fluxes, which contain fluoroaluminates of cesium are disclosed, for example, by Suzuki in US patent 4,670,067 and by Shimizu in US patent 5,171,377. Such fluxes, which may additionally also contain potassium fluoroaluminate fluxing agents, are particularly suitable for brazing aluminum alloys having a higher magnesium content.

For brazing, the fluxing agent (for example, in the form of a suspension) as well as a brazing metal are applied on the components which are to be joined. The components are brought together into the desired position and

US patent 4,906,307 discloses a process for brazing components formed of aluminum alloys. In accordance with one embodiment it is envisioned that a fluxing agent will be used which contains K_2SiF_6, ZnF_2, NaF and AlF_3. Solder plated components are brazed.

For brazing, the fluxing agent (for example, in the form of a suspension) as well as a brazing metal are applied on the components which are to be joined. The components are brought together into the desired position and heated. Initially the fluxing agent melts and cleans the surface; after that, the solder melts. Subsequently, the parts are allowed to cool.

US Patent 5,190,596 teaches that, instead of a brazing metal, a metal can be added to the fluxing agent. During the brazing, this metal forms a eutectic with the aluminum. Suitable metals are copper, zinc and germanium and especially silicon.

The addition of certain metal fluorosilicates in particular amounts can make the brazing metal superfluous (see EP-A-810 057 and German patent application 196 36 897.9). The latter patent application discloses that a mixture of potassium fluoroaluminate fluxing agent and potassium fluorosilicate, in which the latter is contained in an amount of 6 to 50%, makes a brazing metal superfluous.

In the British patent 1,438,955, mentioned above, it is explained that smaller amounts of alkali metal zinc fluorides, up to 5 mole percent, can be tolerated in the fluxing agent. However, their presence does not bring about any advantages in relation to lowering the melting point. Instead, all have the effect of raising the melting point. Haramaki (US patent 4,645,119) discloses fluxing agents composed of potassium fluoroaluminate, which contain 3 to 30 wt.-% of ZnF_2, optionally in the form of $KZnF_3$. The zinc fluoride decomposes at the brazing temperature and the metallic zinc covers the brazed parts or the whole surface of the components which are to be brazed to one another and provides the aluminum with improved protection against corrosion.

It is an object of the present invention to provide a new application method as well as new fluxes, which can be employed for this method. This objective is accomplished by the inventive method, the new flux and the new fluxing agent.

More specifically, the invention as claimed is directed to a method for the manufacture of structural components made by brazing of parts from aluminium or aluminium alloys wherein said brazing is effected by providing the parts made from aluminium or aluminium alloys, applying a fluxing agent containing alkali fluorozincate and optionally auxiliary materials in solid form or as organic suspension, bringing the parts into the desired position and thereafter heating the assembled parts at a temperature from 420 to 590°C to form a brazed joint between the components, wherein the alkali fluorozincate is contained in the fluxing agent in an amount of more than 30 percent by weight.

The invention as claimed is also directed to an organic suspension containing a fluxing agent, wherein said fluxing agent contain or consists of 5 to 95 wt.-% of alkali fluorozincate and 5 to 95 wt.-% of at least one brazing metal, or brazing metal precursor selected from the group consisting of silicon, copper, zinc, germanium and an alkali fluorosilicate, wherein the alkali is potassium, cesium or rubidium.

The invention as claimed is further directed to a fluxing agent consisting of at least 30 wt.-% alkali fluorozincate, the remainder to 100 wt.-% being potassium, fluoroaluminate, cesium fluoroaluminate or potassium fluoroaluminate and cesium fluoro-aluminate.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an X-ray diffraction spectrum of potassium fluorozincate produced in Example 1.

FIG. 2 is an X-ray diffraction spectrum of cesium fluorozincate produced in Example 2.

FIG. 3 is an X-ray diffraction spectrum of cesium fluorozincate produced in Example 3.

FIG. 4 is an X-ray diffraction spectrum of cesium fluorozincate produced in Example 4.

FIG. 5 is an X-ray diffraction spectrum of cesium fluorozincate produced in Example 5.

FIG. 6 is an X-ray diffraction spectrum of sodium fluorozincate produced in Example 6.

FIG. 7 is an X-ray diffraction spectrum of cesium fluorozincate produced in Example 7.

Preferably, x and y are whole numbers, namely, independently of one another, 1, 2, 3, or 4; however, x and y may also be in a sub-stoichiometric relationship to one another. In that case, either x, y or both are then larger than 0, but do not represent a whole number. In this case, it is preferred if y is larger than x.

In the context of the present invention, the term "fluxing agent" refers to those compounds which have the desired surface-cleaning effect (especially the removal of oxide layers) during the brazing. The fluxing agent may consist of alkali fluorozincate; other fluxing agents are then not included. The fluxing agent can also contain other fluxing agents besides alkali fluorozincate. For example, the fluxing agent may represent a mixture of alkali fluorozincate and alkali fluoroaluminate, such as potassium fluoroaluminate and/or cesium fluoroaluminate. The alkali fluorozincate may be present as a pure compound or as a mixture of alkali fluorozincates, such as pure potassium fluorozincate or pure cesium fluorozincate. Moreover, the compounds may exist in one or more phases. For example, pure $KZnF_3$ or also mixtures of $KZnF_3$ and $KZnF_4$ can be used. However, appropriate mixtures with different alkali metal cations can also be used.

Preferred flurozincates include potassium fluorozincate and cesium fluorozincate. These can, of course, also be contained as a mixture.

If cesium fluorozincate is contained as the only fluorozincate in the fluxing agent, it is present in an amount of 5 wt.-% or more. Preferably, the alkali fluorozincate is contained in an amount of more than 30 wt.-%, and especially in an amount of 50 wt.-% or more, in the fluxing agent. The percentages are relative to the fluxing agent, which is set at 100 wt.-%. If the fluxing agents are not pure alkali fluorozincates, other fluxing agents represent the remainder of the mixture up to 100 wt.-%, especially fluxing agents composed of potassium and/or cesium fluoroaluminate.

The fluxing agent frequently can be used as such, without the addition of auxiliary materials. For example, solder-plated aluminum sheet can be brazed with pure fluxing agents. Aside from fluxing agents, the ready-to-use compositions may comprise auxiliary materials. The fluxing agents may also contain auxiliary materials, such as binders, dispersants, brazing metal, brazing metal precursors, solder-forming materials, such as metal fluorosilicates, especially alkali fluorosilicates, or stabilizers. In the inventive method, fluxing agents of pure alkali metal fluorozincate, as well as fluxing agents, which additionally contain potassium fluoroaluminate and/or auxiliary materials, can be employed very well.

If binder is contained in the fluxing agent, it is advisably contained in an amount of 10 to 90 wt.-%. If brazing metal is contained in the fluxing agent, it is advisably contained in an amount of 25 to 75 wt.-%. As described in US patents 5,100,048 and 5,190,596, the fluxing agent may contain admixed solder-forming metals, such as silicon, copper or germanium. These are then contained in an amount of about 10 to about 80 wt.-%. The quantities given above may also be greater or less. The effective minimum or maximum amount can be determined by manual trials (brazing experiments).

As a brazing metal precursor, metal fluorosilicate, such as alkali fluorosilicate, for example, potassium hexafluorosilicate, may also be contained. If it is included, the amount advantageously lies in the range from 5 to 95 wt.-%.

The foregoing percents relate to the whole of the fluxing agent, which is set equal to 100 wt.-%.

As shown in German application 196 36 897.9, it is possible to braze without solder, if at least 6 wt.-% of K_2SiF_6 is contained in the fluxing agent. The same holds true according to EP-A-810 057 for fluxing agents, which contain 7 to 15 wt.-% of metal fluorosilicate, such as Cs_2SiF_6, $CsHSiF_6$, or $CsKSiF_6$. In the case of K_2SiF_6, 25 to 50wt.-% and even up to 75 wt.-% are advantageous. However, even if the metal fluorosilicates are contained in lesser amounts in the fluxing agent, for example, in an amount of 1 to less than 6 wt.-%, the fluxing agent properties with respect to the wetting properties of the surface to be brazed and also the melting point of the fluxing agent are affected positively.

When it is intended to use the fluxing agent in the form of a suspension, dispersing agents may also be contained, which stabilize the suspension.

The fluxing agent can be applied in a known manner on the components of aluminum or aluminum alloys which are to be joined. A dry application based on electrostatic spraying technology is possible because of the good fluidizing properties of the fluxing agents. Alternatively, the fluxing agent may be applied to the materials, which are to be joined, in the form of aqueous or organic suspensions or as a paste. Aqueous or organic suspensions advisably contain 15 to 75 wt.-% of the fluxing agent. Suspensions of the fluxing agent in organic liquids, preferably substances usually used as organic solvents such as alcohols, especially methanol, ethanol, propanol or isopropanol, as well as polyols, can also be used. Other organic liquids ("carriers") include ethers, such as diethylene glycol monobutyl ether, ketones, such as acetone, esters of alcohols, diols, or polyols and binders for the use as paste are, for example, ethyl cellulose. By means of film-forming agents, usually polymers which are soluble in organic solvents such as acetone, fluxing agents can be applied to the workpiece optionally with solder or a solder precursor and, after evaporation of the solvent, form an adherent solid film. Suitable polymers include, for example, methacrylates. The film-forming agent then evaporates during the brazing.

During the application, the brazing metal, if required, may be contained in the fluxing agent (as an admixed powder); it may also already be applied as a plating on the components that are to be brazed or applied additionally to the fluxing agent.

The brazing temperature depends on the solder or the solder-forming metal or the material used. If the soldering metal is liquid at a temperature below 450°C, the process is defined as "soft soldering" or simply as "soldering". If it is a liquid at a temperature above 450°C, the process is referred to as "hard soldering" or "brazing". There are low melting solders, such as zinc-aluminum solders, which can be used for soldering at temperatures above 390°C, or pure zinc solder, which can be used above 420°C. Other solders can be brazed at higher temperatures. Al-Si-(Cu) solders can be used at temperatures of (530°C) or 575°C and higher.

In general, a brazing temperature of up to 600°C is sufficient. Preferably, brazing is carried out at 390°C to 600°C and especially at 420°C to 590°C at atmospheric pressure. Brazing, for example, in a vacuum with evaporation of the fluxing agent, as described in the JP-A 03/099 795, is not contemplated within the present invention. It is possible to flame braze or furnace braze, especially in an inert atmosphere (such as a nitrogen atmosphere).

Known fluxing agents can be used for the inventive process. For example, the Japanese application 72/293 699 discloses fluxing agents composed of potassium fluorozincate in a specific molar ratio. US patent 4,645,119 discloses a fluxing agent composed of potassium fluoroaluminate, which also contains potassium fluorozincate. The potassium fluorozincate was used as additive to improve corrosion and not as a fluxing agent. The European patent application EP-A-0 659 519 discloses a fluxing agent for brazing aluminum; this fluxing agent contains potassium fluoride, zinc fluoride and aluminum fluoride within particular ranges. Potassium fluorozincates possibly may be contained here.

In the following, new fluxing agents are described, which can be used in the inventive method and are also an object of the invention.

One object of the invention is a fluxing agent, which can be used to braze aluminum and aluminum alloys and contains alkali metal fluorozincate and brazing metal or, in particular, a brazing metal precursor, as well as, optionally, alkali metal fluoroaluminate and optionally auxiliary materials. Alkali preferably means potassium, cesium and rubidium. Preferred alkali metal fluorozincates are potassium fluorozincate and/or cesium fluorozincate; a preferred brazing metal precursor is selected from the group consisting of silicon, copper, zinc, germanium, and a metal fluorosilicate, preferably an alkali metal fluorosilicate, particularly potassium fluorosilicate and/or cesium fluorosilicate. If desired, conventional auxiliary materials, such as binders, carriers or stabilizers may be contained. From 2 wt.-% of alkali fluorozincate onwards, positive effects on the brazing behavior may already be noted. The auxiliary materials, such as binders, may be contained in an amount of 10 to 90 wt.-%, based on the total weight of the fluxing agent. In accordance with one embodiment, the fluxing agent preferably contains 5 to 95 wt.-% of alkali fluorozincate (as sole component having flux activity) and 5 to 95 wt.-% of solder or a brazing metal precursor.

If, in addition to the alkali fluorozincate and brazing metal or brazing metal precursor, alkali fluoroaluminate is contained in the fluxing agent, the amounts preferably are 5 to 90 wt.-% of alkali fluorozincate, 5 to 90 wt.-% of solder or brazing metal precursor and 5 to 90 wt.-% of alkali fluoroaluminate. The fluxing agent may consist of these components or auxiliary materials may be contained in an amount of 10 to 90 wt.-%, based on the total weight of the fluxing agent. Pursuant to a particular preferred embodiment, the fluxing agent contains alkali fluorozincate, alkali fluoroaluminate as well as at least one brazing metal precursor. Preferred alkali fluorozincates include potassium fluorozincate and cesium fluorozincate. Preferred brazing metal precursors include silicon, germanium, zinc, copper or an alkali metal fluorosilicate, preferably potassium fluorosilicate or cesium fluorosilicate. The fluxing agent may consist of the components named above. The alkali metal fluorozincate preferably is contained in the fluxing agent in an amount of 2 to 20 wt.-%, the alkali metal fluoroaluminate in an amount of 20 to 80 wt.-% and the brazing metal precursor in an amount of 10 to 50 wt.-%. If desired, conventional auxiliary materials, such as binders, carriers or stabilizers (for the suspension) may be included, preferably then in an amount of 30 to 70 wt.-%, based on the total weight of the fluxing agent.

Yet another object of the invention is a fluxing agent, which can be used for brazing aluminum and aluminum alloys and contains more than 5 wt.-% and preferably more than 5 mole percent, but less than 100 wt.-% of cesium fluorozincate as well as of potassium fluoroaluminate or cesium fluoroaluminate as a remainder up to 100 wt.-%. This fluxing agent preferably contains more than 30 wt.-% and especially 50 wt.-% or more of cesium fluorozincate. It is an advantage of this fluxing agent which, if desired, may contain the usual auxiliary materials such as binders, carriers or stabilizers, that magnesium-containing aluminum alloys can also be brazed very well. This is attributed to the cesium cation. Alternatively, therefore, mixtures of potassium fluorozincate and cesium fluoroaluminate or cesium fluorozincate are also very useful.

Subassemblies produced from brazed parts of aluminum or of aluminum alloys using the inventive fluxing agent, are also an object of the invention.

The required alkali fluorozincates can be prepared in various ways. For example, alkali fluoride, such as cesium fluoride or potassium fluoride, can be melted in the desired ratio with zinc fluoride. Alternatively, it is possible to work in an aqueous solution. For example, an aqueous solution of alkali fluorides and zinc fluoride can be reacted to form alkali zinc fluoride and the precipitated alkali zinc fluoride may be filtered out, if desired. For this purpose, a zinc fluoride solution which, if desired, has been prepared fresh from zinc oxide and aqueous hydrofluoric acid, is reacted with a potassium fluoride solution, which also, if desired, has been freshly prepared from potassium hydroxide and aqueous hydrofluoric acid. For the working up, the precipitated solid is separated from the aqueous, supernatant solution and then dried. In accordance with a different procedure, a solution of alkali bifluorides (that is, adducts of hydrofluoric acid and alkali fluoride) is reacted with zinc oxide. In this way, the alkali fluoride and/or the zinc fluoride can be produced in solution by an anionic exchange reaction between alkali salts or zinc salts and hydrofluoric acid or alkali bifluoride or ammonium bifluoride.

Information concerning phase diagrams, based on thermal and X-ray analyses, are described by O. Schmidt-Dumonat and Horst Bernefeld in Z. anorg. allgemein. Chem. 287 (1956), pages 120 to 137. Information concerning $Ca_4Zn_3F_{10}$ is provided by D. Babel in Z. Naturfrosch. 29a (1965), pages 165 and 166. A new method for preparing fluoro metallates is described by M.K. Chaudhuri, S.K. Ghosh and Z. Hiese in J. Chem. Soc. Dalton Trans. (1964), pages 1763 to 1964.

Contrary to what was assumed in the prior art, alkali fluorozincates are suitable as fluxing agents for brazing aluminum or aluminum alloys, such as Mg-Al alloys at temperatures of 600°C and below. It is not necessary to work in a vacuum with the vapor of the fluxing agent. The residue is not corrosive and can be painted over. The palette of known fluxing agents is extended in a manner, which could not have been anticipated.

The following examples are intended to explain the invention further without limiting its scope.

Examples

Example 1:

Preparation of Potassium Fluorozincate (JF 009400)

Zinc oxide is reacted with aqueous hydrogen fluoride to form a zinc fluoride solution (Solution 1). Solution 1 is added with stirring to a previously prepared aqueous potassium fluoride / hydrofluoric acid (Solution 2 of 23.3 g of potassium fluoride and 16 g of hydrofluoric acid). Stirring is continued for a further hour and the precipitated solid is filtered out. The solid is dried in a circulating-air oven at 110°C.

Yield: 95.4% of the theoretical

Analysis: X-ray diffraction confirms pure $KZnF_3$; identification with reference spectrum (see Figure 1/7).

DTA to 650°C shows no identifiable phase conversions.

Example 2:

Preparation of Cesium Fluorozincate (JF 009403)

Cesium hydroxide (30 g) is reacted with an aqueous solution of hydrofluoric acid to form CsF-HF. To this solution, 16.3 g zinc oxide are added in portions with stirring. The working up is as described in Example 1.

Yield: 52.8% of the theoretical.

Analysis: 33.9% of cesium, 37.9% of zinc

X-ray diffraction as in appendix; no available reference spectrum (see Figure 2/7).

DTA: several onsets, particularly at 368.5°C, 558.8°C and 664.6°C.

Example 3:

Preparation of Cesium Fluorozincate (JF 009404)

Cesium hydroxide (60 g) is reacted with an aqueous solution of hydrofluoric acid to form CsF-HF. To this solution, 16 g of zinc oxide are added in portions with stirring. The working up is as described in Example 1.

Yield: 52.8% of the theoretical.

Analysis: 49.0% of cesium, 27.2% of zinc

X-ray diffraction as in appendix; no available reference spectrum (see Figure 3/7).

DTA: small onset 499°C, main peak at 583°C onset.

Example 4:

Preparation of Cesium Fluorozincate (JF 009415)

As in Example 3; however, stirring is continued for 2.5 hours at about 90°C. The product is worked up as in Example 1.

Yield: 67.3% of the theoretical.

Analysis: 58% of cesium, 26.1% of zinc

X-ray diffraction(see Figure 4/7); no available reference spectrum.

Example 5:

Preparation of Cesium Fluorozincate (JF 009418)

Cesium hydroxide (45 g) is reacted with an aqueous solution of hydrofluoric acid to form CsF-HF. To this solution, 16.3 g of zinc oxide are added in portions with stirring and stirring is continued for 2 hours at 80°C. The working up is as described in Example 1.

Yield: 73.5% of the theoretical.

Analysis: 85.5% of cesium, 36.2% of zinc

X-ray diffraction, no available reference spectrum (see Figure 5/7).

DTA: Onsets at 502.4°C, 556.3°C and 586.4°C.

Example 6:

Preparation of Sodium Fluorozincate (JF 009419)

Sodium hydroxide (16 g) is reacted with an aqueous solution of hydrofluoric acid to form NaF-HF. To this solution, zinc oxide (32.6 g) is added in portions with stirring. The working up is as described in Example 1.

Yield: 95.0% of the theoretical.

Analysis: X-ray diffraction, identification with reference spectrum 20 11 82 (see Figure 6/7).

DTA: Onset at 648.4°C.

Example 7:

Preparation of Rubidium Fluorozincate (JF 009420)

Rubidium hydroxide (20.5 g) is reacted with an aqueous solution of hydrofluoric acid to form RbF-HF. To this solution, 16.3 g of zinc oxide are added in portions with stirring. The working up is as described in Example 1.

Yield: 93.8% of the theoretical.

Analysis: X-ray diffraction, reference spectrum 20 10 16 (see Figure 7/7)

DTA: Maxima at 638.6°C and 683.9°C

Brazing Tests

General Brazing Conditions:

On an aluminum or aluminum magnesium coupon (25 mm x 25 mm), with or without a solder or solder plating, a defined amount of fluxing agent together with one or two drops of isopropanol are spread by rubbing on the surface of the coupon in order to obtain a uniform distribution of the fluxing agent on the surface. Subsequently, this coupon is provided with an aluminum angle (approximately 45°, length 40 mm, height 5 mm). After waiting until the isopropanol has evaporated, the coupon is then placed into a preheated brazing furnace (at about 400°C in the case of ZnAl solders and at 520°C in the case of AlSi(Cu) solders), through which a controlled atmosphere (nitrogen, dew point -40°C) is flowing and heated to the brazing temperature (brazing the angle to the coupon at temperatures as high as 600°C) (so-called CAB brazing processes). Nocolok® is potassium fluoroaluminate.

Flux/Coverage	3 g/m^2 Al 3003 + Al angle	5 g/m^2 Al 3003 + Al angle	7 g/m^2 Al 3003 + Al angle	5 g/m^2 Al 3003 + solder + Al angle	5 g/m^2 Al plated with 4050 + Al angle	10 g/m^2 Al plated with 4050 + Al angle	10 g/m^2 AlMg + solder + AlMgl angle	10 g/m^2 AlMl + solder + Al angle	5 g/m^2 Al + solder AlMgl angle
JF 009400 $KZnF_3$				AlSi12 solder brazed 100%	Brazed very well		Zn-solder, 1,5 cm not brazed		
JF 009403 **$CsZnF_3$**					**inhomogeneous brazed joint**	**brazed satisfactorily 6 min**			
JF 009404 **Cs_2ZnF_4**		**ZnAl 5/2 brazed** 100%			**Brazed very well**				
JF 009415 **$CsZnF_3$**					1,5 cm **not brazed**	1,5 cm **not brazed**			
JF 009400 JF 009400 + Si-Powder 2 : 1	**brazed very well** 100%	**brazed very** well, 100% too much solder			**Brazed very** well, 100% too much solder		**Not** brazed		
JF 009400 JF 009400 + AlSi12 1 : 1			**brazed** very well 100%		**Brazed** very well 100%				
JF 009403 **JF 009403 +** AlSi12 1 : 1			not brazed		**1.5 cm** not brazed				
JF 009404 **JF 009404 +** **AlSi12 1 : 1**		1.5 cm **not brazed**	>90% **brazed**		Brazed very well 100%				
$KF + ZnF_2$ (spread by rubbing)			not brazed		Brazed very well 100%				
JF 009404 JF 009404 + K_2SIF_6 1:2 spread by rubbing			**15 g/m^2** very good						
$CsAlF_4$ / JF009404				**ZnAl 5 solder** 100% Zn solder100%			**Zn solder** not brazed		

Flux/Coverage	3 g/m^2 Al 3003 + Al angle	5 g/m^2 Al 3003 + Al angle	7 g/m^2 Al 3003 + Al angle	5 g/m^2 Al 3003 + solder + Al angle	5 g/m^2 Al plated with 4050 + Al angle	10 g/m^2 Al plated. with 4050 + Al angle	10 g/m^2 AlMg + Solder + AlMgl angle	10 g/m^2 AlMl + Solder + Al angle	5 g/m^2 Al + Solder AlMgl angle
JF 009404 JF009404 / Nocolok® 1 : 1 mixture				4145 solder brazed 100%			not brazed	AlSi 12 brazed 50%	AlSi 12 brazed 100%
JF 009400 JF 009400 / K$_2$SiF$_6$ 1:2 spreadby rubbng		brazed very well 100%							
JF 009400 JF009400 / Nocolok® 1 : 1 mixture				4145 solder brazed 100%					
JF 009418				brazed 100%	Brazed 100%				
JF 009419						brazed only at points			
JF 009420				AlSi 12 solder brazed 100%	Brazed 100%		15 g/m^2 with solder AlSi 12 coupon + angle 6063, brazed 100%	with solder AlSi 12, coupon 6063 + Al angle brazed 100%	
JF 009404 JF 009404 + Si Powder 2 : 1			brazed well 60%						
JF 009400 JF 009400 + Sil Flux 2 : 1			brazed well 100%						
JF 0094004 JF 009404 + Sil Flux 2 : 1			brazed well 60%						

CLAIMS

1. A method for the manufacture of structural components made by brazing of parts from aluminium or aluminium alloys wherein said brazing is effected by providing the parts made from aluminium or aluminium alloys, applying a fluxing agent containing alkali fluorozincate and optionally auxiliary materials in solid form or as organic suspension, bringing the parts into the desired position and thereafter heating the assembled parts at a temperature from 420 to 590°C to form a brazed joint between the parts, wherein the alkali fluorozincate is contained in the fluxing agent in an amount of more than 30 percent by weight.

2. The method of claim 1, wherein potassium fluorozincate or cesium fluorozincate or both potassium fluorozincate and cesium fluorozincate are contained in the fluxing agent.

3. The method of claim 1, wherein the alkali fluorozincate is contained in the fluxing agent in an amount of 50 percent by weight or more.

4. The method of claim 1, wherein, in the fluxing agent consists of alkali fluorozincate or alkali fluorozincate and auxiliary materials.

5. The method of claim 1, wherein, in addition to the alkali fluorozincate, potassium fluoroaluminate or cesium fluoroaluminate is contained in an amount less than 70 wt.-%

6. The method of claim 1 or 4, wherein the fluxing agent contains substances selected from the group consisting of binders, brazing metal, brazing metal precursors and suspension stabilizers, as said auxiliary materials.

7. The method of claim 6, wherein the fluxing agent contains alkali fluorosilicate, wherein the alkali is potassium, cesium or rubidium, as said brazing metal precursor.

8. The method of claim 7, for a solderless brazing of aluminum and aluminum alloys, wherein the fluxing agent contains the alkali fluorosilicate in an amount of at least 5 to 95 wt.-%, as said brazing metal precursor.

9. The method of claim 8, wherein the alkali fluorosilicate is potassium fluorosilicate.

10. The method of claim 1, wherein the suspension is an alcoholic suspension.

11. The method of claim 1, wherein the brazing is carried out in a controlled atmosphere or in a non-oxidizing flame.

12. The method of claim 1, wherein a magnesium-containing aluminum alloy is brazed.

13. A fluxing agent, for use in brazing aluminum and aluminum alloys, which contains or consists of at least 30 wt.% of alkali metal fluorozincate, and a brazing metal precursor, wherein the alkali is potassium, cesium or rubidium and wherein the metal precursor is selected from the group consisting of silicon, copper, zinc, germanium and an alkali fluorosilicate, wherein the alkali is potassium, cesium or rubidium.

14. A fluxing agent according to claim 13, further comprising alkali metal fluoroaluminate.

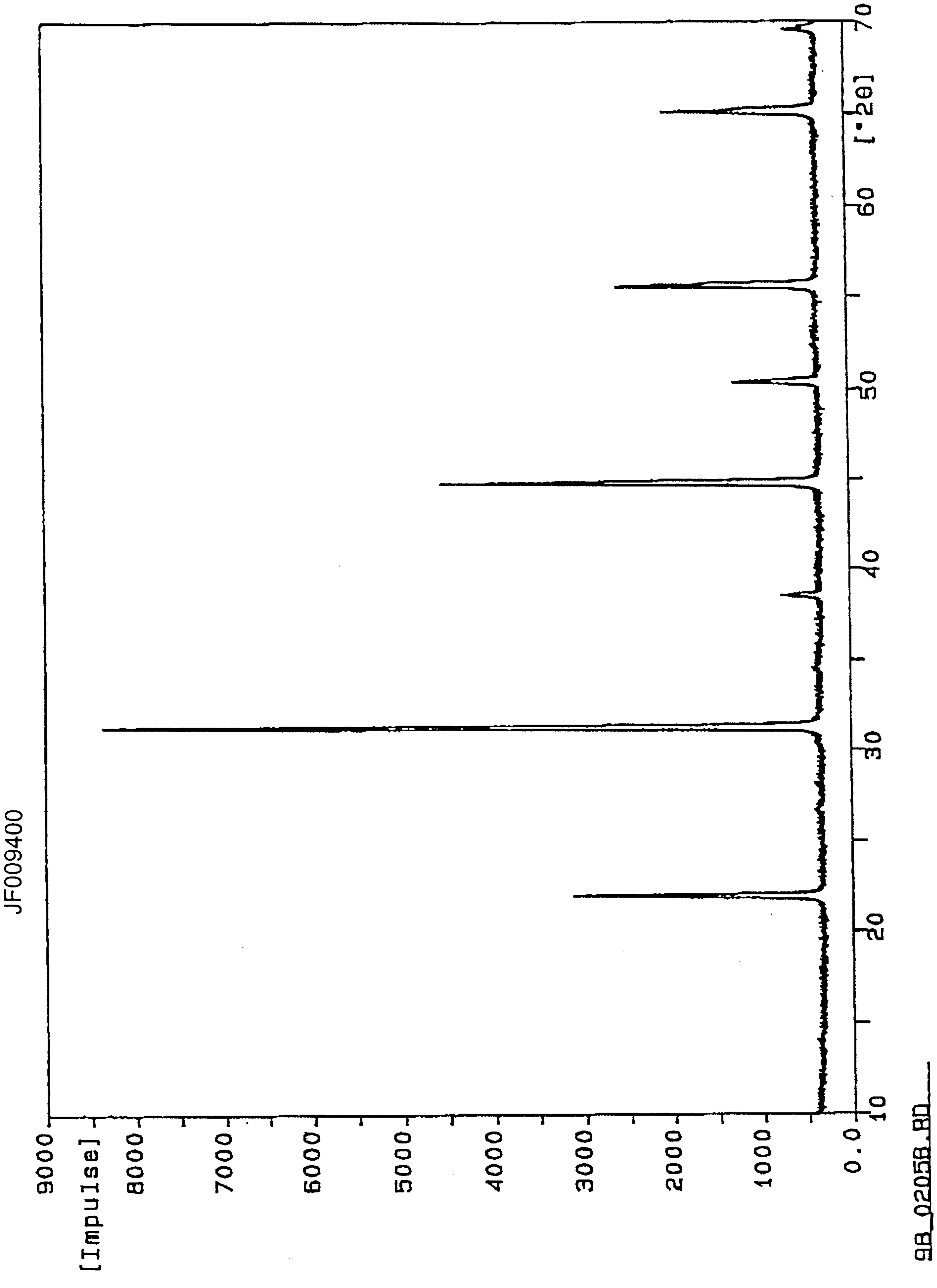
15. A fluxing agent, for use in brazing aluminum and aluminum alloys, which contains more than 5 wt. percent and less than 100 wt.-% of cesium fluorozincate.

16. A fluxing agent according to claim 15, containing more than 30 wt.-% of cesium fluorozincate.

17. An organic suspension containing a fluxing agent, wherein said fluxing agent contain or consists of 5 to 95 wt.-% of alkali fluorozincate and 5 to 95 wt.-% of at least one brazing metal, or brazing metal precursor selected from the group consisting of silicon, copper, zinc, germanium and an alkali fluorosilicate, wherein the alkali is potassium, cesium or rubidium.

18. The organic suspension of claim 17, wherein the fluxing agent contains or consists of 5 to 90 wt.-% of alkali fluorozincate, 5 to 90 wt.-% of brazing metal precursor and 5 to 90 wt.-% of potassium fluoroaluminate.

19. A fluxing agent consisting of at least 30 wt.-% alkali fluorozincate, the remainder to 100 wt.-% being potassium fluoroaluminate, cesium fluoroaluminate, or potassium fluoroaluminate and cesium fluoro-aluminate.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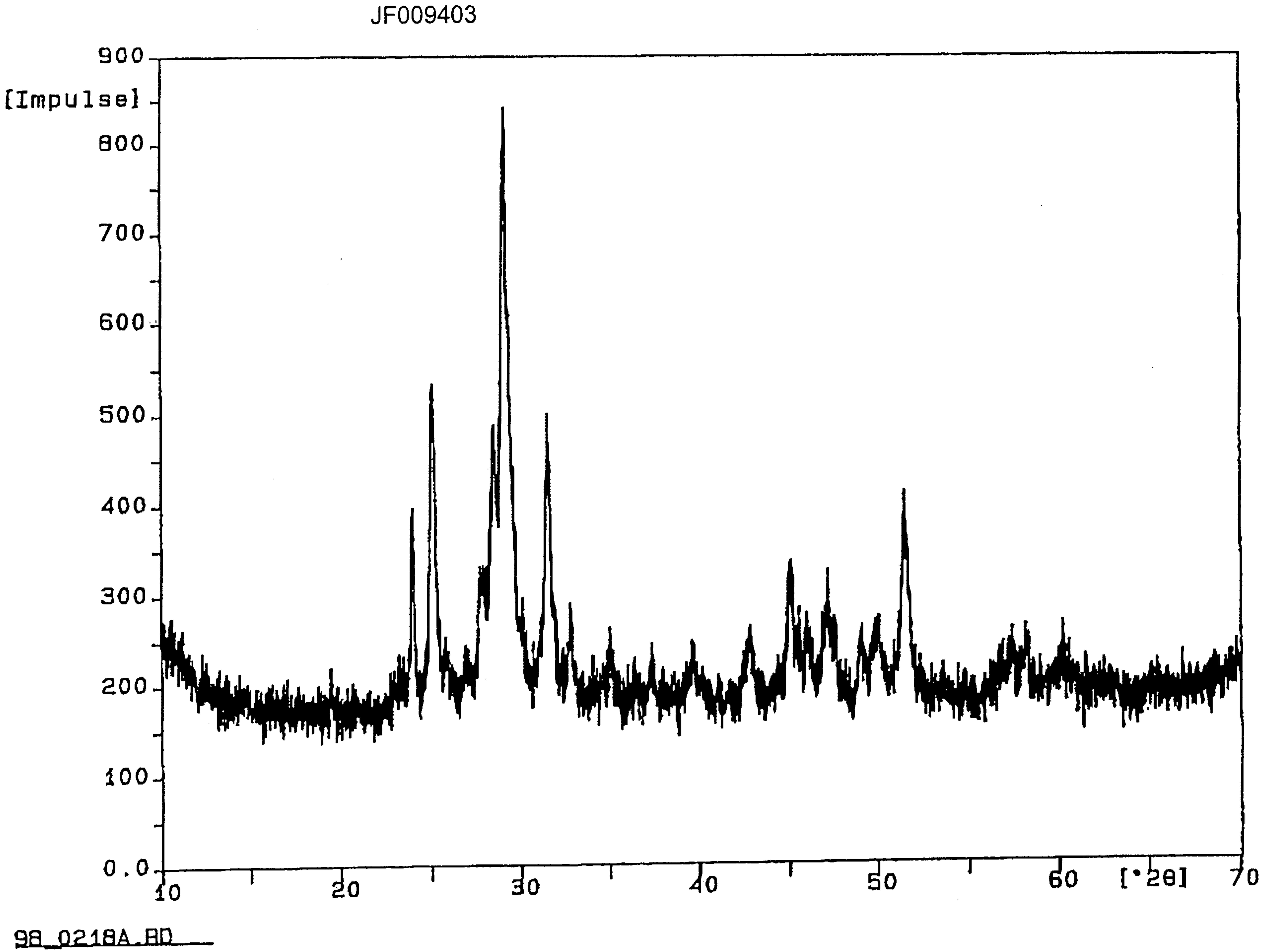
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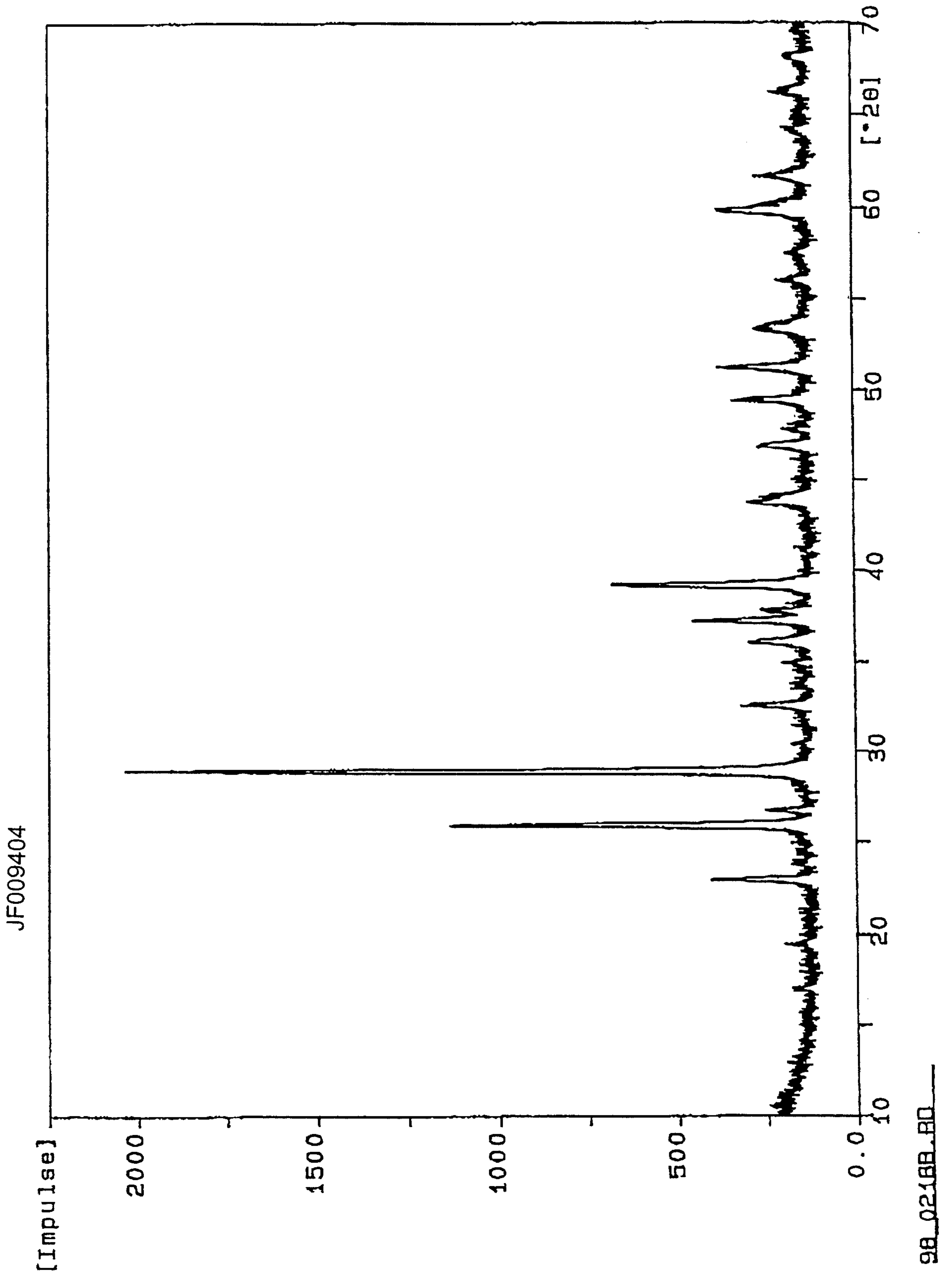
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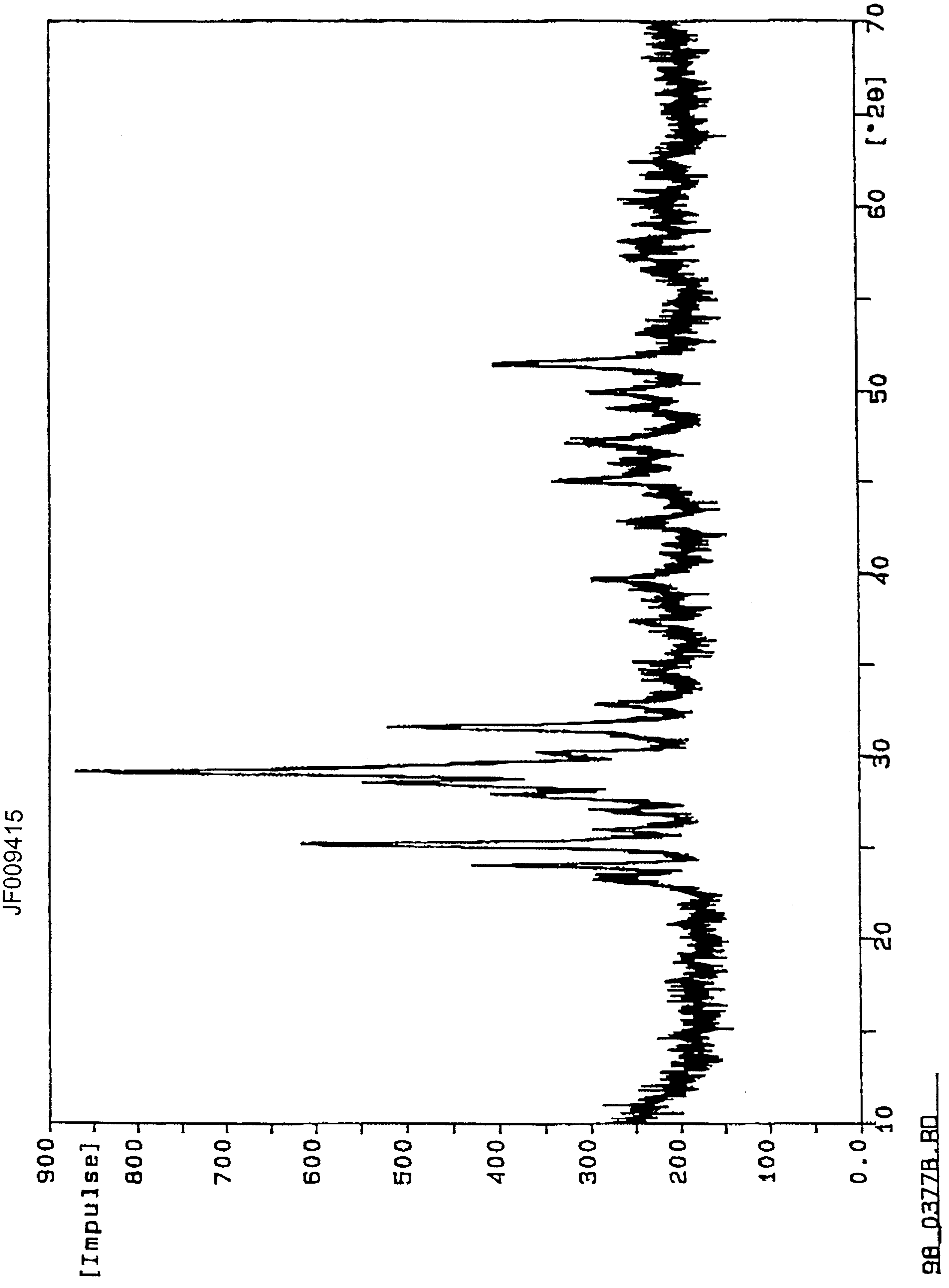
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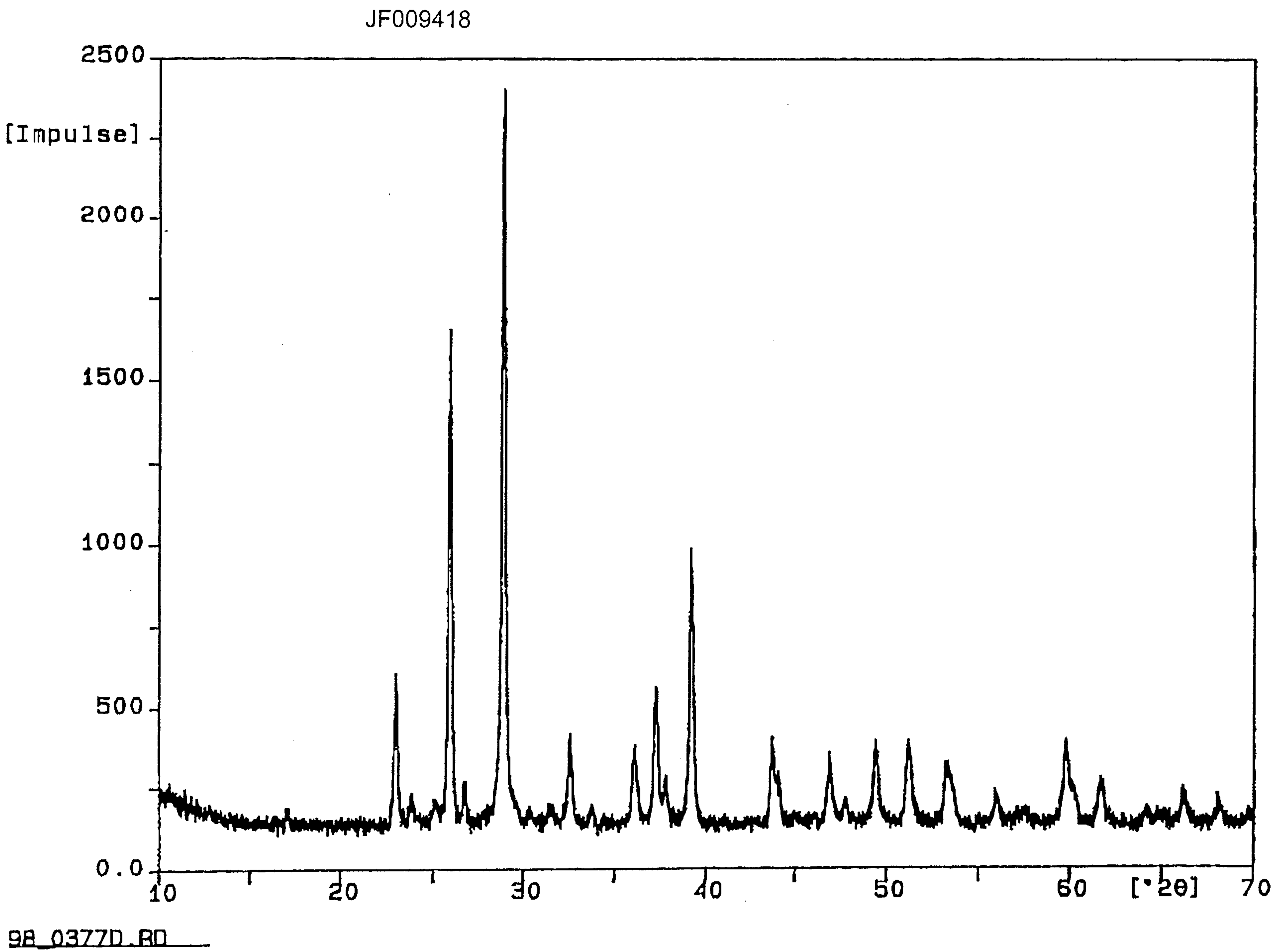
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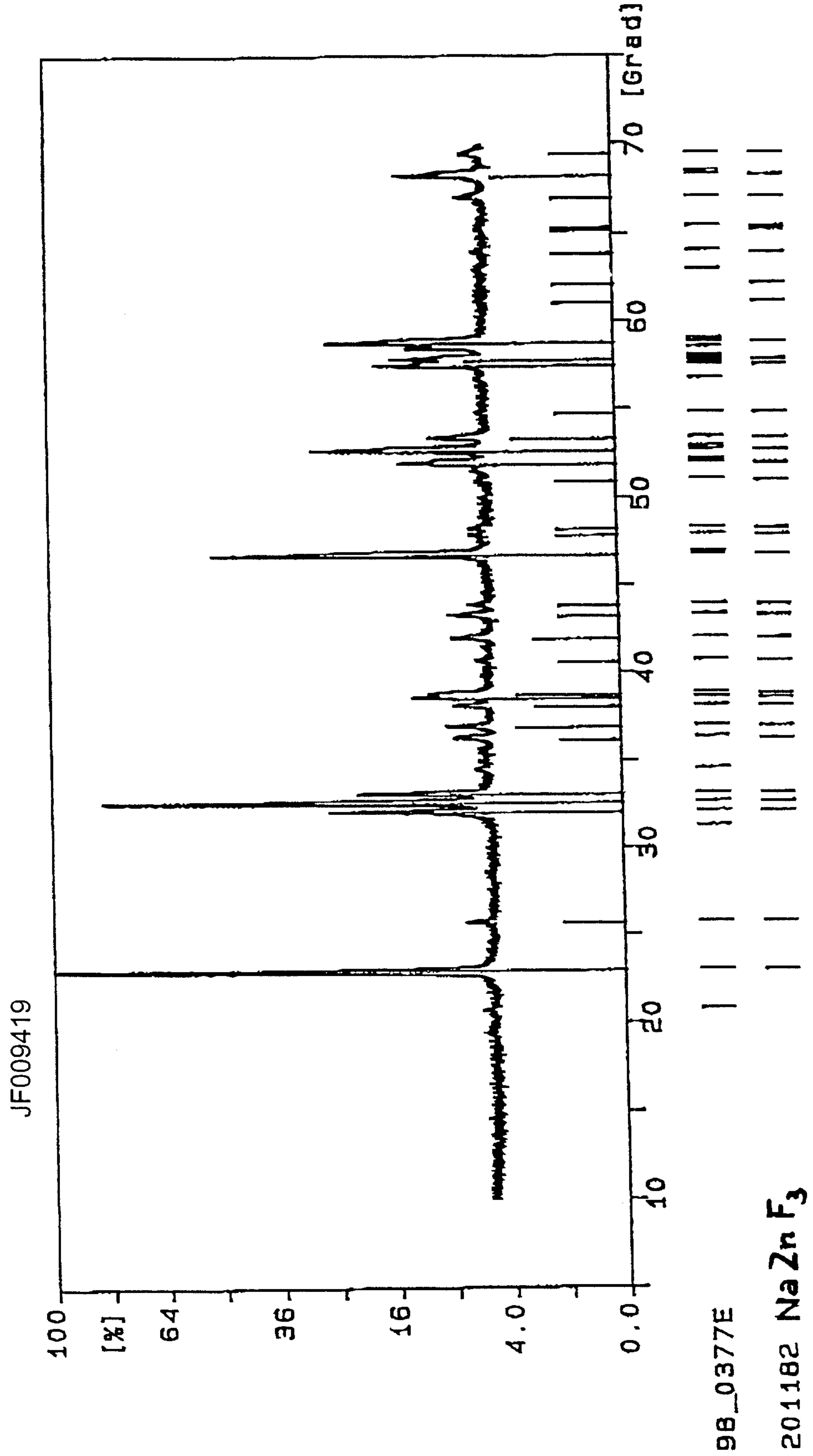
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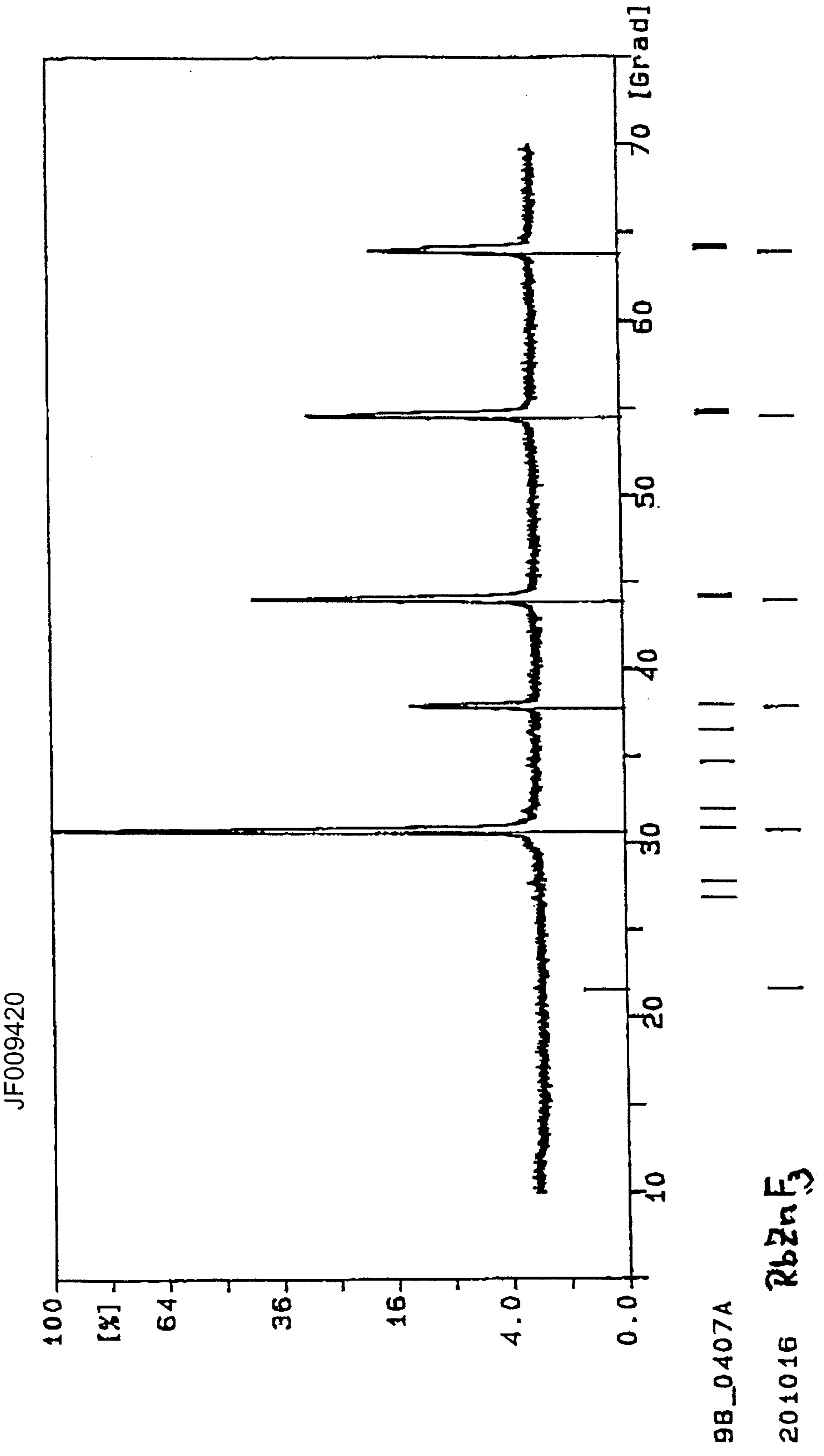
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