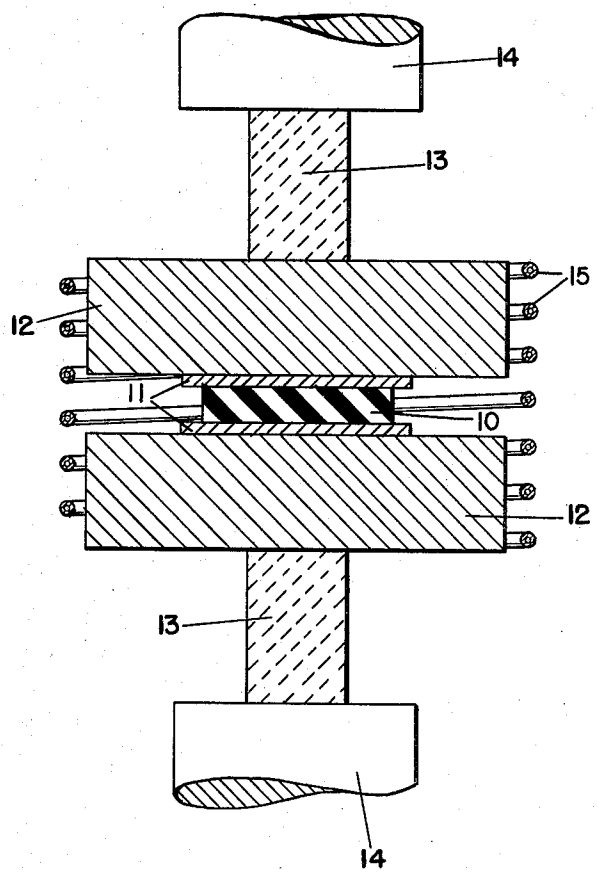
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MEANS FOR REDUCING THERMAL GRADIENTS IN THE HOT-PRESSING OF SYNTHETIC MICA

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MEANS FOR REDUCING THERMAL GRADIENTS IN THE HOT-PRESSING OF SYNTHETIC MICA

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The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to us of any royalty thereon.

This invention relates to improved hot-pressing apparatus for synthetic mica and more particularly concerns the uniform recrystallization of synthetic mica by eliminating or reducing thermal gradients involved in their hot-pressing.

In copending applications by McNeill et al., "Method of Making Lamellar Sheets of Fluorphlogopite Mica," Serial No. 38,673, filed June 24, 1960, and "Apparatus for Electrophoretic Deposition of Lamellar Fluorphlogopite Mica Sheets," Serial No. 108,209, filed May 5, 1961, both assigned to the assignee hereof, a method and apparatus for making lamellar polycrystalline sheets of synthetic mica by electrophoretic deposition were disclosed. The lamellar deposits resulting therefrom represent approximately one-half the theoretical density of pure natural mica, and in order for such material to find use in various electrical applications, the deposits must subsequently be converted, such, for example, as by hot-pressing, into flexible and impermeable sheets of sufficient dimensions. The hot-pressing of mica, however, is unique, in that its study positively indicates a considerable weight loss from the decomposition therof at temperatures upwardly of about 900° C., and due principally to the volatilization of fluorides contained therein. At temperatures approaching 1300° C. or higher, wherein the mica becomes recrystallized, the weight loss thereof is very rapid.

The hot-pressing of mica by an oscillating high-frequency electric current inherently permits very rapid thermal cyclings which is highly desirable in its application to mica, since this material is subject to excessive surface decomposition when held at its recrystallization temperature for long periods. A principal disadvantage of high-frequency induction heating in the hot-pressing of mica however, resides in the production of undesirable thermal gradients in the normally employed circular graphite blocks adjacent their outer rims which results in a non-uniform mica.

We have overcome this problem by making the graphite blocks of prescribed oversize dimensions to provide an inner area of near-uniform temperature. Further, the pressure transmitting members contacting the graphite blocks comprise a low heat transfer coefficient material, such as mullite, to prevent the introduction of additional gradients at this inner area.

It is a principal object of this invention to provide an improved hot-pressing apparatus wherein depositions of polycrystalline lamellar sheets of synthetic mica may be successfully converted to generally transparent crystalline mica sheets of sufficient dimensions which are flexible and impermeable.

The exact nature of this invention as well as other objects and advantages thereof will be apparent from consideration of the following description and single drawing illustrating a vertical section of the improved hot-pressing apparatus of the invention immediately prior to pressing.

For purposes of clarity of illustration, the press equipment, induction heating apparatus, methods of cooling and other standard pieces of equipment normally used in conjunction with hot-pressing are not shown. Such equipment is employed in connection with the present invention, but forms no part thereof. The apparatus hereinafter described is adapted to be attached to and to be utilized in connection with any standard press machine and induction heater. For example, a 60 ton press manufactured and sold by Manley Company of York, Pennsylvania, affords the necessary mechanism for effecting sufficient pressure on the mica to be pressed. Similarly, the induction heater may be a Lepel High Frequency Induction Heater, Lepel, Inc., Woodside, New York.

Referring now to the drawing, there is shown an electrophoretic deposit of polycrystalline mica **10** for forming into a non-porous and flexible sheet. The mica will preferably be approximately ½–3 inches in diameter, but may be of any shape, although a generally rectangular or circular piece will ordinarily be used. A pair of molybdenum sheet discs **11—11** are removably arranged in sandwiching relation to the mica **10**. While molybdenum is preferred for this purpose, platinum and palladium have been found to work satisfactorily. A graphite block **12**, suitably cylindrical in design although not specifically limited thereto, is vertically positioned against the exposed side of each of the molybdenum discs.

In accordance with the invention, the graphite blocks **12—12** will have a greater diameter than the molybdenum discs **11—11**, which, in turn, will be slightly larger than the mica piece. We have found that uniform recrystallization of the mica will occur even though the temperature of the graphite blocks is raised to about 1300° F. in less than 30 minutes providing the mica piece is overlapped therearound by at least about 1 inch of the blocks.

Following customary practice, the graphite blocks, molybdenum discs and mica piece will have therearound an air-tight shield, not shown, to provide for passage of a suitable inert gas therethrough. The molybdenum discs are chemically inert in the presence of these gases and not subject to attack by volatile fluoride gases given off by the mica as would be the graphite surfaces in the absence of the molybdenum discs. Refractory punches **13—13**, suitably of mullite, and positioned as shown, serve to transmit pressure from steel punch holders **14—14** which are secured to the press by any conventional means. The holders **14—14** will normally be water-cooled while the inductor coils **15**, surrounding the graphite blocks, will be suitably of copper tubing to permit passage of cooling water therethrough.

In the practice of the invention, the mica will be sandwiched by the molybdenum discs. The sandwiched mica will then be centrally positioned between the graphite blocks and the entire assembly axially aligned to rest on the lower mullite punch. The upper punch will be brought into contact with the upper graphite block and the shield positioned. The chamber enclosed by the shield will next be flushed with gas after which the heating process may be started.

We claim:

Apparatus for use in inductively hot-pressing a lamellar polycrystalline sheet of synthetic mica comprising a pair of discs made of a metal selected from the group consisting of molybdenum, platinum and palladium for receiving said mica therebetween, a graphite block disposed vertically outwardly of each disc and axially aligned therewith, said graphite blocks being of sufficient dimensions to overlap said mica therearound by at least about 1 inch, inductor coils surrounding said graphite blocks, and means to transmit pressure to the mica to be pressed.

References Cited in the file of this patent

UNITED STATES PATENTS

2,471,128	Stein	May 24, 1949
2,526,699	Gard	Oct. 24, 1950
2,936,218	McNeill et al.	May 10, 1960