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PROCESS AND COMPOSITION FOR TREATMENT OF MAGNESIUM PRIOR TO SPOT WELDING

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1 In order to spot weld articles made of aluminum or aluminum alloys it is necessary to remove the surface coating thereon. There exists processes of etching aluminum and aluminum alloy articles to remove the surface coating in which the article is immersed in an aqueous acid etching bath. At present, however, there exists no commercially employed process for etching magnesium in such an aqueous etching bath. Magnesium is much too reactive a metal to be etched by the aqueous baths now employed for etching aluminum and aluminum alloys. Accordingly the cleaning of magnesium surfaces prior to spot welding has heretofore been carried out by the use of steel wool.

It is a general object of the present invention to provide a composition and process for cleaning magnesium prior to spot welding through the use of an aqueous etching material.

The composition and process of the present invention does not require the immersion into the aqueous etching composition of the entire article to be spot welded. The composition and process of the present invention will effect etching of the magnesium article to be spot welded merely by brushing over a portion thereof to be spot welded a relatively aqueous etching composition. Essentially the composition and process of the present invention is an aqueous material including certain acidic etching ingredients and certain sequestering agents or organic reducing agents. The acidic etching agents, or some thereof, are materials of viscous nature and having the property of confining its action in the etching composition to the surface of the magnesium article to be etched. Such viscous acid etching agents are provided by the use of polystyrene sulfonic acids. These polystyrene sulfonic acids in the composition have a property of etching the coating on the magnesium article without allowing, however, a deep penetration of the etching composition into the surface so that the activity of the acidic composition is confined only to the coating which is desired to be etched and removed. The polystyrene sulfonic acids employed are producible in either of two ways, i. e., through either first polymerizing styrene and then sulfonating the same, or by first sulfonating styrene and then polymerizing it, the latter being the preferred method. It is principally the molecular weight of the polystyrene molecule which determines the viscosity of the polystyrene sulfonic acid. Where the styrene is sulfonated and then polymerized it is easier to produce a polystyrene sulfonic acid of desired molecular weight and

viscosity than is the case where the styrene is first polymerized and then sulfonated. The process of sulfonating polystyrene alters the molecular weight.

5 The acidic etching composition also includes an aryl sulfonic acid, those having less than four alkyl carbon atoms being found usable, such as benzene, toluene or xylene sulfonic acids. The sulfonic acids employed, both the polystyrene acid and aryl sulfonic acid, are thought to etch the surface coating from magnesium articles by hydrolyzing to some extent to release sulfuric acid in active form, the activity of which is confined to the surface coating because of the viscosity and low penetrating properties of the composition.

A further important element of the composition used for the purpose of the present invention is the employment of a sequestering agent which is also an organic reducing agent. In the etching of magnesium certain magnesium compounds or complexes are formed which interfere with the etching action unless taken in solution by the etching composition. The composition of the present invention therefore includes sequestering agents which operate to keep magnesium and certain alloy elements in solution and prevent their precipitation and deposition on the part being treated. Suitable agents for this purpose are any water soluble aliphatic hydroxy carboxylic acids or ammonia or sodium salts thereof. If the composition is made using ammonia or sodium salts of the water soluble aliphatic hydroxy carboxylic acids the acids themselves are available in the composition. Examples of suitable water soluble aliphatic hydroxy carboxylic acids are citric acid, tartaric acid, gluconic acid, gluconic delta lactone, as well as the sodium or ammonia compounds thereof.

10 In the art the effectiveness of a process of cleaning magnesium prior to spot welding is commonly measured by a standard apparatus for determining the electrical resistance of the surface after the cleaning operation. Using this standard apparatus to test the surface derived by the use of the composition and process of the present invention it is found possible to reduce the surface resistance of the coating to about 20 to 40 micro-ohms in about five or ten minutes of treatment. The surface resistance increases after the treatment gradually with time but only to about 80 to 100 micro-ohms in about forty-eight hours. Magnesium surfaces having surface resistance of this order are found satisfactory for spot welding and therefore the process

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and composition of the present invention are enabled to satisfactorily clean magnesium surfaces for spot welding without the necessity of the use of steel wool, which is the present practice.

The composition and process of the present invention, together with further advantages of the invention, will be understood from the following description of a preferred composition and process. A preferred composition comprises:

	Per cent
Xylene sulfonic acid-----	5
28° Baumé ammonia-----	0.5
Glucona delta lactone-----	6.75
Polystyrene sulfonic acid-----	6
Water -----	81.75

In the foregoing preferred composition any aryl sulfonic acid with less than four alkyl carbon atoms may be substituted for the xylene sulfonic acid, such as benzene sulfonic acid, toluene sulfonic acid and the aryl sulfonic acid content may vary within the range of from 2% to 10%. In the composition any water soluble aliphatic hydroxy carboxylic acid, such as citric acid, tartaric acid, or gluconic acid, may be substituted for the glucona delta lactone and the quantity of such sequestering agent may vary in the composition from 5% to 25%.

The 28° Baumé ammonia is employed in the composition since it has some beneficial effect in the desired sequestering action but may be omitted when desired. In the preferred composition the ammonia content is about 0.2% but it may vary when employed within the limits of about 0.1% to 1.7%, and in addition thereto or alternately the composition may include equivalent amounts of the sodium ion, either introduced into the composition by employing the sodium salts of the water soluble aliphatic hydroxy carboxylic acid in place of the acid itself, or in any other manner. The polystyrene sulfonic acid in the composition may vary in the range of 2% to 10% and the most desirable viscous properties of the solution, as well as the etching properties, are obtained when using polystyrene sulfonic acids having molecular weights in the order of 20,000 to 250,000.

While the particular composition and process herein described for etching and cleaning magnesium preparatory to spot welding are well adapted to carry out the objects of the present invention, this invention is of the scope set forth in the appended claims.

We claim:

1. A composition for cleaning magnesium which comprises, a viscous aqueous solution including essentially polystyrene sulfonic acid and aryl sulfonic acid having less than 4 alkyl carbon atoms and a water soluble aliphatic hydroxy carboxylic acid sequestering agent.

2. A composition for cleaning magnesium which comprises, a viscous aqueous solution including essentially polystyrene sulfonic acid and aryl sulfonic acid having less than 4 alkyl carbon atoms and a water soluble aliphatic

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hydroxy carboxylic acid sequestering agent, the proportions of polystyrene sulfonic acid being between 2% and 10%, the sequestering agent employed being between 5% and 25%, the aryl sulfonic acid being between 2% and 10%.

3. A composition for cleaning magnesium which comprises, a viscous aqueous solution including essentially polystyrene sulfonic acid and aryl sulfonic acid having less than 4 alkyl carbon atoms and a water soluble aliphatic hydroxy carboxylic acid sequestering agent, the composition also including ammonia.

4. A composition for cleaning magnesium which comprises, a viscous aqueous solution including essentially polystyrene sulfonic acid and aryl sulfonic acid having less than 4 alkyl carbon atoms and a water soluble aliphatic hydroxy carboxylic acid sequestering agent, the proportions of polystyrene sulfonic acid being between 2% and 10%, the sequestering agent employed being between 5% and 25%, the aryl sulfonic acid being between 2% and 10%, the composition also including ammonia from 0.1% to 1.7%.

5. A process of cleaning magnesium prior to spot welding which process comprises, applying to the surface to be spot welded a viscous etching composition, which viscous etching composition is an aqueous composition including essentially polystyrene sulfonic acid and aryl sulfonic acid of less than 4 alkyl carbon atoms, and a water soluble aliphatic hydroxy carboxylic acid sequestering agent.

6. A process of cleaning magnesium prior to spot welding which process comprises, applying to the surface to be spot welded a viscous etching composition, which viscous etching composition is an aqueous composition including essentially polystyrene sulfonic acid and aryl sulfonic acid of less than 4 alkyl carbon atoms, and a water soluble aliphatic hydroxy carboxylic acid sequestering agent, the proportions of polystyrene sulfonic acid being between 2% and 10%, the sequestering agent being between 5% and 25%, the aryl sulfonic acid being between 2% and 10%.

7. A process of cleaning magnesium prior to spot welding which process comprises, applying to the surface to be spot welded a viscous etching composition, which viscous etching composition is an aqueous composition including essentially polystyrene sulfonic acid and aryl sulfonic acid of less than 4 alkyl carbon atoms, and a water soluble aliphatic hydroxy carboxylic acid sequestering agent, the composition also including ammonia.

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