



UK Aluminium Industry Fact Sheet 16

Aluminium Powder and Paste

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Introduction

Over many years, a wide range of products in the form of particulate aluminium have been developed.

The main categories currently commercially available are:

- a. atomised aluminium powder
- b. aluminium flake powder
- c. aluminium paste.

Atomised aluminium powder is granular or spherical in particle shape whilst flakes or pastes, which are produced by either mechanical stamping or ball milling, are flattened platelets.

Atomised Aluminium Powder

Aluminium powder is produced by presenting pure molten aluminium metal to a compressed gas jet and converting it to fine droplets, which are then solidified and collected. Powders so collected are subsequently graded, depending on size, specification and application.

The range of particle sizes of the product made in this way can be controlled to some extent by varying the nozzle opening, the air pressure and other factors. A wide range of particle size is available from the finest, 5 microns up to 1000 microns.

The characteristic that differentiates aluminium powder from aluminium in the massive form is the very large surface area to weight ratio. The production of aluminium metal from the oxide requires considerable energy. The reverse reaction, the oxidation of fine aluminium powder, is exothermic and, because of the large surface area, the reaction occurs rapidly. Consequently aluminium powder is used in explosives, both in peaceful and also military applications. Aluminium powder combined with oxygen is used in rocket launching. Other uses include hot-tops in the steel and iron foundry industry, de-oxidising of steel and production of aluminium chemicals.

An increasing usage of aluminium powder is in powder metallurgy. It has led to more highly developed powder-making processes and a much wider range of subsequent fabricating techniques. Rapid solidification technology, metal matrix composites and mechanical alloying, for example,



combined with powder extrusion, rolling and forging are presenting opportunities for creating new alloys and forms of material. These have tailor-made properties which are more attractive for the aerospace, automobile and other industries.

The energy involved in many of the uses of aluminium powder, particularly for explosives and rocketry, illustrates the potentially hazardous nature of this product which needs to be addressed during production, storage and usage.

Aluminium Flake Powder

This is made by dry ball milling of atomised aluminium under inert atmosphere or removal of solvent from wet-milled atomised aluminium under controlled conditions.

It is generally 6 – 35 microns average particle size, the smaller sizes tending to be more hazardous to

handle. Depending on application, some flake may be 'stabilised' by a coating to limit reactivity.

Application of these products is:

- a. in gas concrete (lightweight concrete) production

Because aluminium powder reacts with water to produce hydrogen, aluminium powder can be used to make "lightweight" concrete, the gas bubbles forming as the concrete sets, producing a porous concrete.

- b. in explosives (as sensitiser)
- c. in printing inks.

Aluminium Paste

This is made from aluminium foil or aluminium powder, depending on the end use, by ball milling in white spirits solvent with lubricant present.

The parameters of milling determine the nature of the product but generally it will be a two-dimensional flake, of a mean size from 8 – 35 microns in diameter (the third dimension is very small 0.1 – 0.5 micron). Dry ball milling in the presence of an inert gas is practised for special end uses. The majority of paste is made from 99.5 – 99.7% aluminium.

The solvent component is usually white spirits and/or naphtha, but special products are available with other solvents according to use, such as isopropyl alcohol, ethyl acetate, xylene etc.

The generic types of product available are:-

- i. leafing paste
- ii. non-leafing paste

About 80% of all production is leafing paste and the most usual applications are:-

- a. in anti-corrosion paints
- b. reflective roof coatings with bitumen etc.
- c. as feed to aluminium flake powder production
- d. in printing inks

The other 20% of production is non-leafing aluminium paste which has wide application as a coloured paint pigment. It is used in industrial finishes of many kinds:-

- e. hammer finish
- f. coil coating
- g. automotive paints
- h. in printing inks.

Automotive paints use high performance non-leafing pigments and use a very high purity aluminium, 99.97%, because of its relative lack of reaction with dilute acids.

Further information about aluminium and aluminium alloys, their production, fabrication and end use can be obtained from:

- (1) European Aluminium Association in Brussels
www.eaa.net
- (2) International Aluminium Institute in London
www.world-aluminium.org