



# Durable Coatings for Durable Products

## Arkema Rilsan® PA11 Fine Powder Coatings

The use of powder coatings in the automotive industry is increasing for economic, quality and environmental reasons. A variety of parts, some visible but many more inconspicuous, require extra protection as well as a decorative finish. Wheels, door handles, oil and fuel filters, engine blocks and coil springs are some of the many automotive products to which powder coatings are applied.

The trend for increasing performance through high quality solutions while reducing or maintaining costs has helped highlight the performance offered by polyamide 11 (PA11) coatings, marketed by Arkema as Rilsan® fine powders, designed to significantly extend the lifetime of metal parts. Environmentally friendly, Rilsan® PA11 is produced from a renewable raw material of plant origin (Castor Oil), and is free of any heavy metal based pigments. Chemical majors like Arkema are working extensively to develop effective powder coating solutions which meet the expectations of car, bus and truck manufacturers. Introduced in the early 50's, Rilsan® fine powders were developed to protect metal parts from corrosion, and have since met the most stringent specifications of the automotive industry in a growing range of applications. Arkema also offers Primgreen®, a highly flexible waterborne primer,

specially designed to be compatible with Rilsan® fine powders and various metal substrates. Very easy to process and environmentally friendly, Primgreen® can provide the highest level of anticorrosion properties when combined with Rilsan® PA11 coatings.

Three examples illustrate the versatility of Rilsan® polyamide 11 functional powder coatings:

### **Coating of spline shafts (trucks and 4WD vehicles) and steering shafts**

The protection of metal parts involved in the transmission mechanisms of trucks and 4WD vehicles is an absolute necessity, particularly in order to increase their lifetime while reducing noise and maintenance. Replacing the traditional "metal to metal" contact by a "metal to polymer" contact, the Rilsan® PA11 coating is a well-known protective solution for spline shafts in transmission systems, and has been used for many years by all major truck manufacturers.

The coating can be applied either on the male or the female part, and offers a range of properties such as excellent creep resistance under load, self-lubrication (no need for additional grease), outstanding abrasion resistance (15mg loss, Taber test) and chemical resistance (inertness to oils) at

high temperature, to name but a few.

One other advantage offered by this "metal-to-polymer" contact is to dramatically reduce vibration and improve noise dampening. Based on the overall performance of the Rilsan® coating, the lifetime of a coated spline shaft is increased by a factor of seven compared to uncoated parts. For this kind of parts, Rilsan® coatings are applied by the dip-coating method, whereby the pre-heated metal parts are dipped into a fluidised powder bed. The coating thickness achieved is generally 300 to 400µm. This is adjusted to match precisely the required dimensions during the subsequent broaching operation, as polyamide 11 coatings are tough and flexible, and can be machined exactly like metal. The performance and the ease of application of Rilsan® coatings on drive shafts has recently been extended to steering shafts, offering car manufacturers a much greater ease of adjustment and functionalities for their steering systems. Several colours (black, blue, grey, green, natural, etc.) have been approved by OEMs, who use Rilsan® to differentiate their own brands in the market place.

### **Sliding Door and Seat Rails**

Initially introduced for commercial vans and utility vehicles, the concept of sliding

doors has become extremely popular in Europe, Japan and the USA. It is now a proven solution to facilitate the opening / closing of many passenger cars and minivans. Stainless steel rails have often been seen as 'the solution' for this application, due to the anticorrosion properties and attractive appearance of this metal. This was and still is particularly true in Germany and Japan.

However, stainless steel remains an expensive raw material, difficult to bend and unpleasant during use as much noise is generated when the door slides onto it. To reduce the noise and promote cheaper alternatives, several coating solutions have been developed, primarily thermoset materials, namely epoxy and polyesters. These powder coatings rapidly showed their limit, either because of their mediocre corrosion or impact protection, or because of their poor abrasion resistance, which is nowadays a key factor for carmakers as doors become heavier. Rilsan® PA11 coatings have been chosen instead, offering a large range of properties required by the application: extremely low coefficient of friction (0.15 - 0.30 for static K and 0.05 - 0.20 in Dynamic K), corrosion protection (2000hrs of salt spray test), outstanding abrasion protection (200,000 cycle resistance under 17kg load), very good chemical and UV resistance, attractive finish, and excellent noise dampening properties. Rilsan® PA11 coatings are traditionally applied on rails by the electrostatic spraying method, the parts being placed in an oven for a few minutes to melt the powder, and then cooled down. The coating thickness reaches 100-150µm. Alternatively, the coating can be applied by the dip-coating method. As a thermoplastic, polyamide 11 powders produce a finished protective film with all its properties almost

immediately after the parts have cooled down, at a considerably higher speed than thermoset powders, thereby reducing oven residence time with the resulting energy savings. Although black has been the most popular colour for the coating of sliding door rails until now, new metallic colours have been developed for Rilsan® fine powders, and were recently approved for new passenger cars in Europe, demonstrating that both aesthetic and functional requirements can be met with one single product.

### **Interior parts**

Many small items used in the automotive industry are concealed, but require tough and resistant coatings as they are subjected to severe operating conditions. One of the shortcomings of many commercially available powder coatings used for small parts like screws, clips, springs, staples or safety belt buckles is their poor edge coverage. This means that the thickness deposited on a thin narrow edge barely reaches a few microns, and this becomes the weak point in the finished part since it can easily be chipped, abraded, or attacked by corrosion. Impact strength and abrasion resistance are critical in most applications, both to ensure a long lifetime for the coated parts and to reduce rejects after manufacturing and shipping. Thanks to the length of the molecular chains constituting the Rilsan® material, PA11 coatings exhibit an excellent coverage of the part with a fairly thick coating on sharp edges, guaranteeing a well-protected part. Effective coating technologies have been developed by Arkema for small parts, which can vary from 1cm to 15cm in overall size. Such processes, known as Minicoat or Maxicoat depending on the size of the part to be coated, help coat up to 50,000 items per hour. The principle is simple: a small pre-

heated item drops into a Rilsan® PA11 powder vibrating bowl, and the powder immediately melts onto the surface thanks to the residual heat in the item. The surface finish can be smoothed down subsequently using a post-fusion oven.

The advantage of this coating technique is to avoid hanging points while fully protecting small parts, with very good productivity. Therefore, small concealed items use Rilsan® coatings to aid lubrication and to be protected from heat and chemicals next to the engine block or inside door panels. In the interior compartment of the vehicle, the smooth and pleasant warm-to-the-touch finish of Rilsan® coatings is highly recognized and appreciated. Powder coatings are now a proven metal protection. Driven by increasingly stringent requirements, the automotive industry will continue using materials that provide both aesthetic and functional properties on a variety of metal substrates. Rilsan® fine powders offer one of the largest combinations of high performance properties, meeting the need of manufacturers to promote higher quality and performance solutions. Finally, Rilsan® PA11 coatings give greater flexibility to designers and possible differentiation, normally at a smaller cost than traditional solutions. With Rilsan® durable coatings, there are endless possibilities to make and invent durable products. ■

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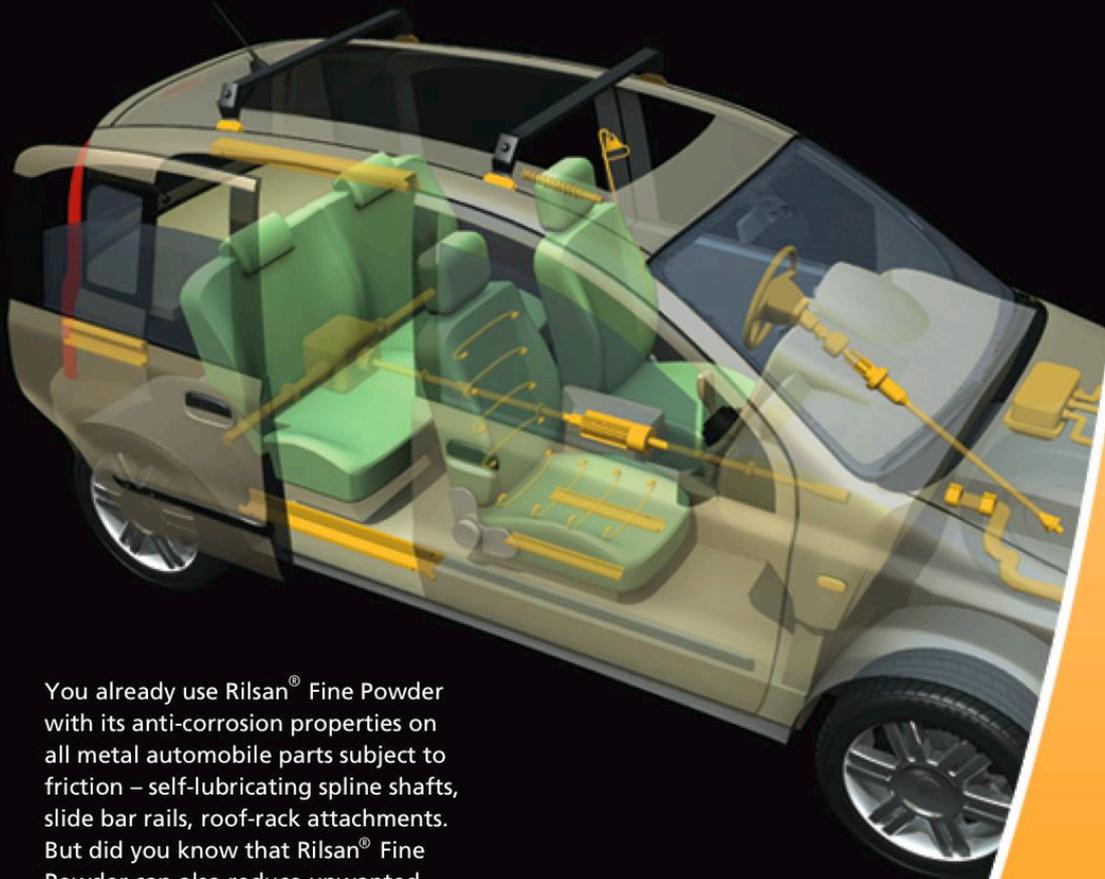
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# No corrosion, no noise, no limits: Rilsan® fines powders



You already use Rilsan® Fine Powder with its anti-corrosion properties on all metal automobile parts subject to friction – self-lubricating spline shafts, slide bar rails, roof-rack attachments. But did you know that Rilsan® Fine Powder can also reduce unwanted noise in the car engine and passenger compartment? Engine pipes, seat springs, safety belts fasteners... With Rilsan® Fine Powder, there are endless possibilities and plenty more still to be invented!

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