

## **Create Opportunities and Value in Rotomoulding by Using Rilsan PA12**

### **Abstract**

We all know the rotational moulding industry is dominated by polyethylene (PE) - over 90% of rotomoulded products are made from LLDPE and HDPE. Because of its fundamental properties like low zero shear viscosity, very good impact performance, chemical resistance and durability, PE has gained a dominant but deserved role in the industry. Although moulding PE is very easy and forgiving in comparison with other rotational moulding materials, we have seen in recent times an increasing demand towards engineering materials and added value resins. We all know PE cannot be the solution to every technical problem due to some inherent limitations such as a lack of high temperature resistance, high modulus (stiffness) and fuel barrier properties.

Expanding the horizon of rotomoulding by learning how to use materials like polypropylene (PP), polyamide (PA) or Kynar (PVDF) can add value to rotomoulded products and expand the product range rotomoulders can offer enabling them to penetrate and develop new markets.

Diversifying the product range by using non-PE materials is often viewed by rotomoulders as being too complicated and outside their comfort zone, but experience has shown that moulders can be well rewarded for developing novel and sophisticated solutions, using existing equipment, that cannot be easily copied by competitors.

The article will be focused on why rotomoulders should explore the potential of PA12 and the added value PA12 would bring to their customers.

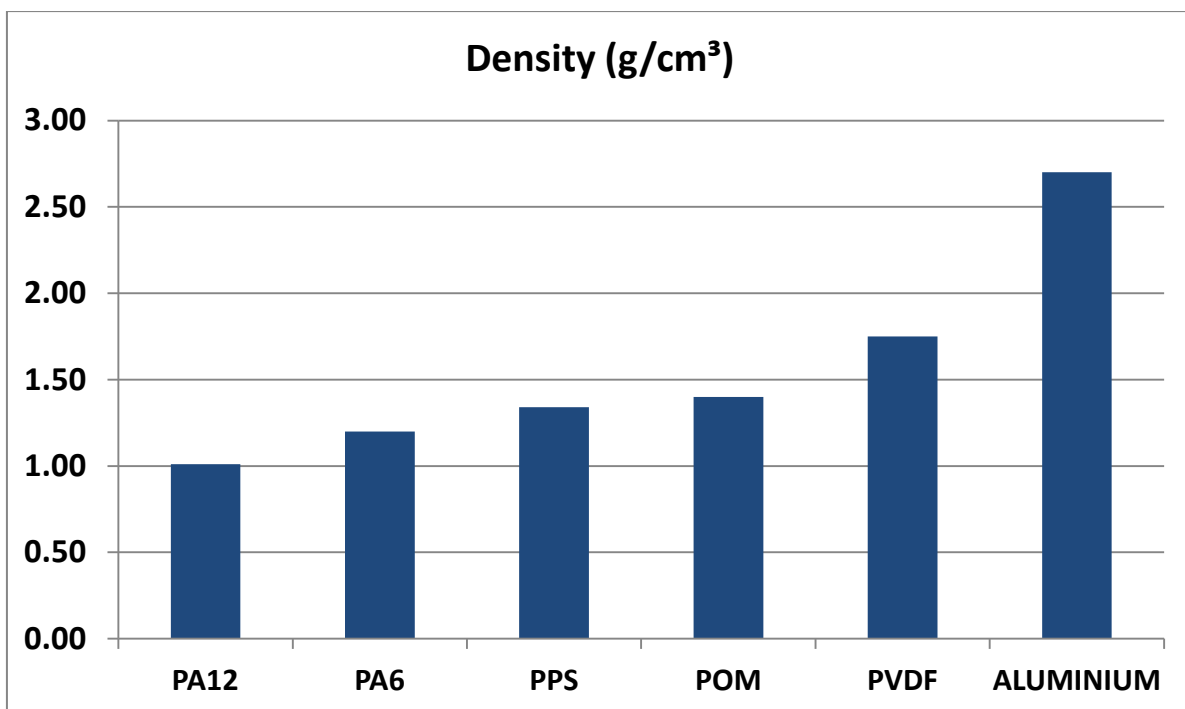
### **Introduction**

The study is an insight on the rotomouldable polyamide grade Rilsan PA12 by looking at fields of applications, properties, and practical aspects of this high performance polymer. Polyamide is a high performance grade with a unique combination of properties. Compared to other high performance and engineering plastics, polyamide delivers an outstanding level of chemical, thermal and impact properties. This unique combination of properties allows to use the polyamide in a wide variety of highly demanding applications, including packaging, automotive (e.g. air brake tubes and fuel lines), oil and gas flexible pipes, sporting equipment (e.g. soles for sport shoes and ski top layers), medical devices, cable and electrical components.



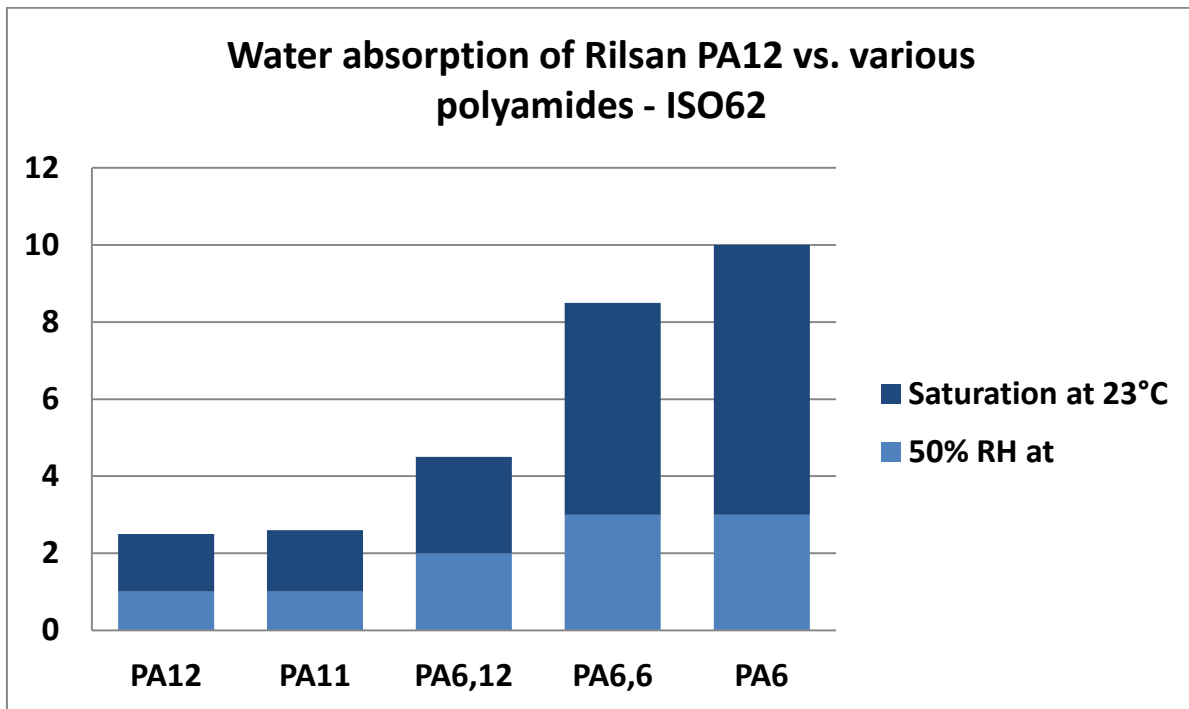
### Why Rilsan PA12

Compared to other high performance polymers, Rilsan PA12 offers very low density, some 3 to 6 times lighter than metal. This is a significant economic advantage when studying the cost versus performance aspect of using Rilsan PA12. Test results are shown in figure 1.



*Figure 1 – Density of various polymers and Aluminium as per ISO 1183*

Cryogenically ground, Rilsan PA12 is sealed in bags offering a very low moisture absorption and outstanding dimensional stability in comparison with other polyamide grades; see figure 2 for details.

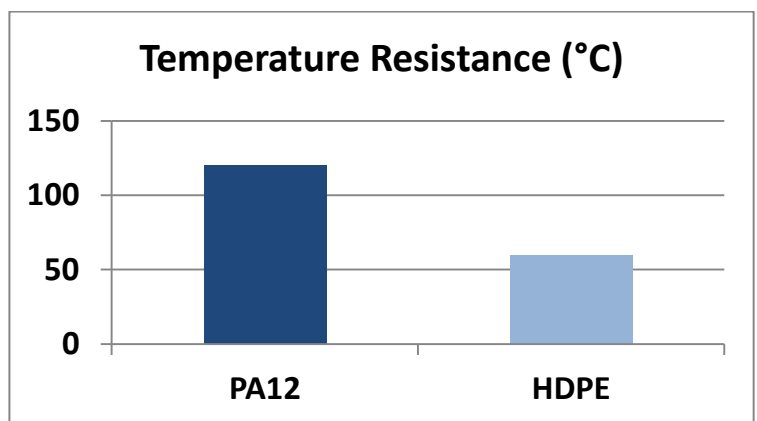


**Figure 2 – Water absorption comparison.**

Rilsan PA12 is semi-crystalline polymer with a melting temperature of approx 160 °C much higher than any polyethylene (PE) with very good high temperature resistance. Since PA12 has also an outstanding chemical resistance a typical application can be hot oil hydraulic tank. In Matrix we have developed an internal test method to measure the operating temperature resistance of a moulded tank. We tested one made from Rilsan PA12 when pressurised hot oil was pumped in, figure 3 illustrates the device and results are shown in figure 4.



**Figure 3 – System used to measure the operating temperature**



**Figure 4 – Comparison of temperature Resistance**

A fundamental parameter to evaluate is the impact strength. We have found this parameter to be very important in assessing the quality of rotomoulding materials. In Matrix we have impacted Rilsan PA12 in accordance to the ARM test method. It involves dropping a standard dart on rotomoulded sample plaques from varying heights and computing an average weighted impact energy to failure. We have found this test to be reliable, repeatable and highly practical for rotomoulded products. By using a hexagonal test mould, rotomoulded plaques (125 x 125 x 3 mm) were produced and the internal air temperature profile was recorded for each of the moulding conditions. The sample plaques were then conditioned at -40 °C for at least 24 hours before being impacted. Figure 5 illustrates the impact variation versus moulding conditions. To make the laboratory testing conditions were similar to a production environment a carousel rotational moulding machine Ferry RS1.90 was used as illustrated in figure 6.

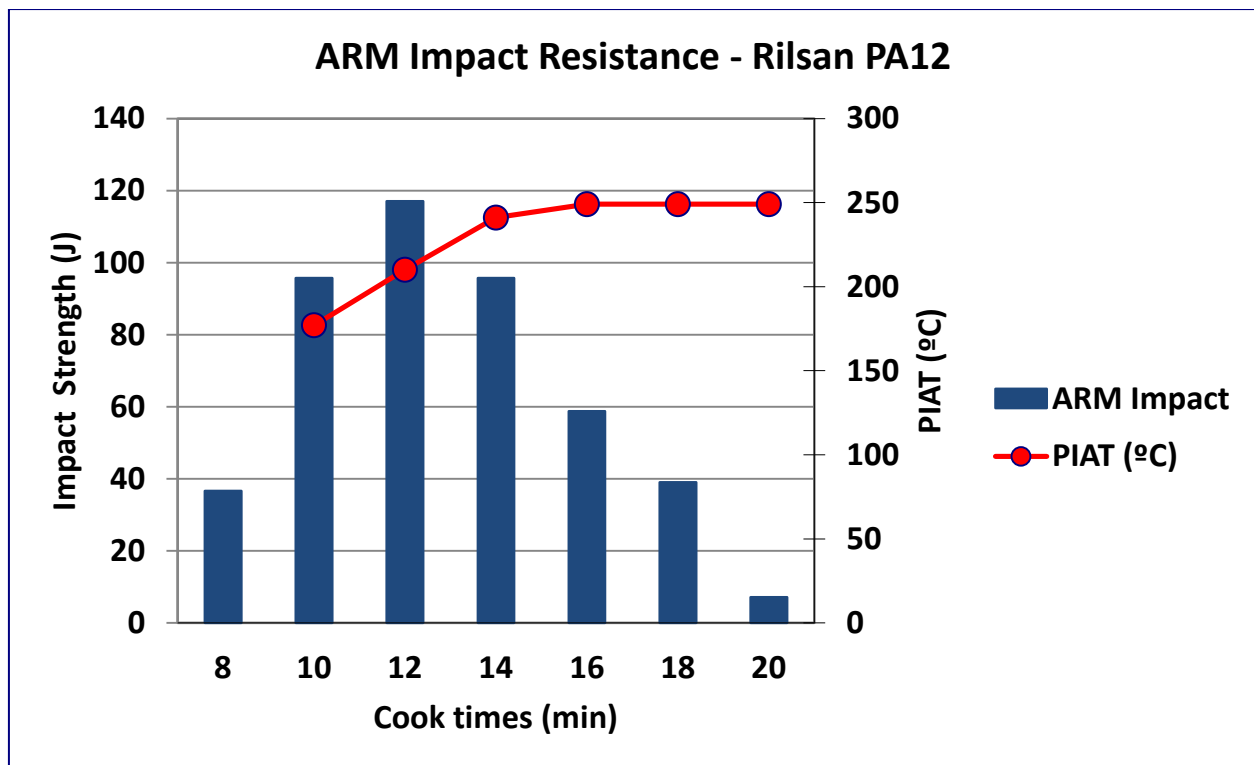


Figure 5 – ARM Impact Strength Rilsan PA12 on rotomoulded samples

By calculating the impact energy it is possible to establish at which moulding conditions Rilsan PA12 reaches the optimum performance, as it is shown in figure 5.



**Figure 6 – Matrix Polymers Ferry RS. 1.90**

### **Moulding PA12**

Rilsan PA12 has better resistance to oxidation (degradation) than PA6 and does not require an inert atmosphere (typically nitrogen) when processing. Moreover being a semi-crystalline polymer it is possible to monitor the internal air temperature profile and observe consistently the transition points as illustrated in figure 7 such as melting temperature, peak temperature and crystallisation temperature. Monitoring and assessing the internal temperature profile will help to achieve the optimum moulding conditions. In comparison to any other engineering polymers Rilsan PA12 is by far very easy to mould.

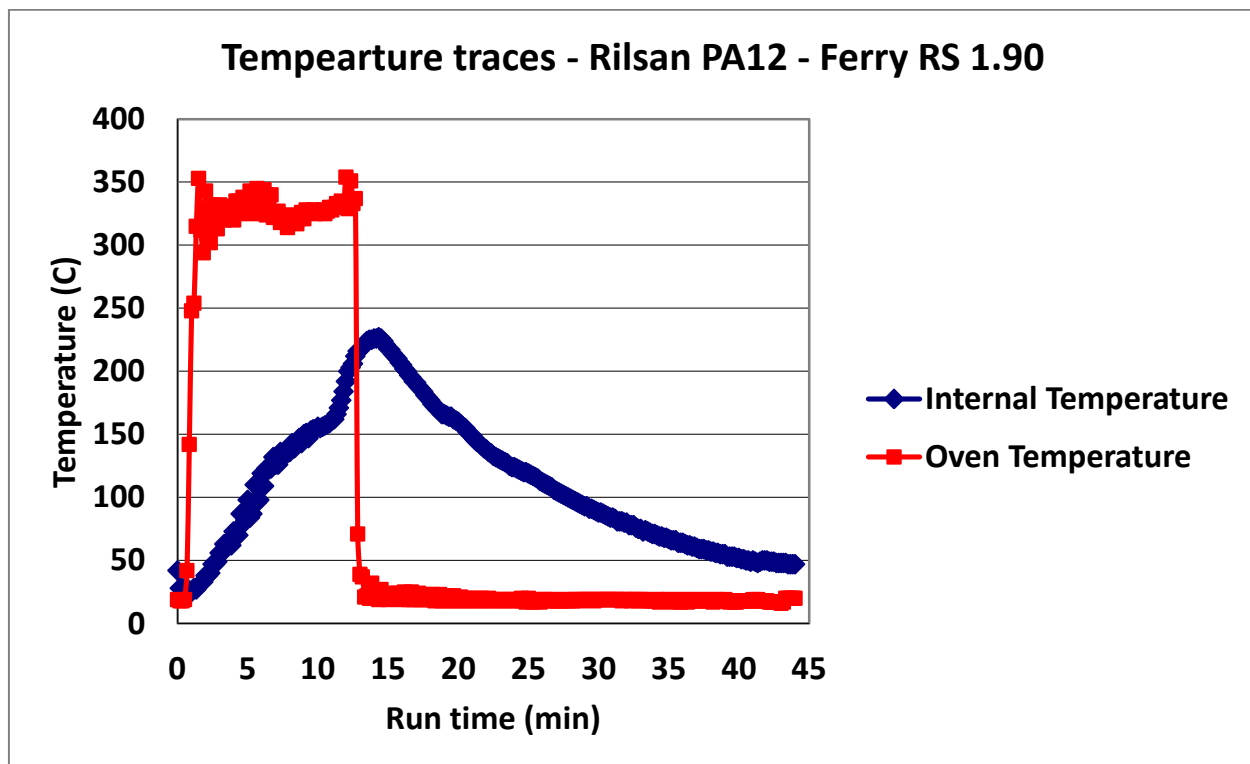


Figure 7 – Internal Air temperature profile monitored at Matrix conditions

## Conclusion

A peculiar characteristic of rotomoulding is the limited range of polymer types that can be used to produce a successful part. During the process, virtually no shear is applied to the polymer melt and relatively few polymers have suitable rheological characteristics to enable them to sinter and flow under zero shear conditions. For this reason Polyethylene (PE), as we all know, has been the predominant polymer used in rotomoulding. However there is a need for new rotomoulding materials that will sustain the growth of the rotomoulding market which are not PE grades. We have seen an increasing demand for engineering polymers and added value materials like Rilsan PA12. PA12 is a material that is already contributing to the growth of the industry due to its unique combination of properties.

For any additional information about PA or any other product please visit [www.matrixpolymers.com](http://www.matrixpolymers.com) or contact the author at [aldo.quaratino@matrixpolymers.com](mailto:aldo.quaratino@matrixpolymers.com)