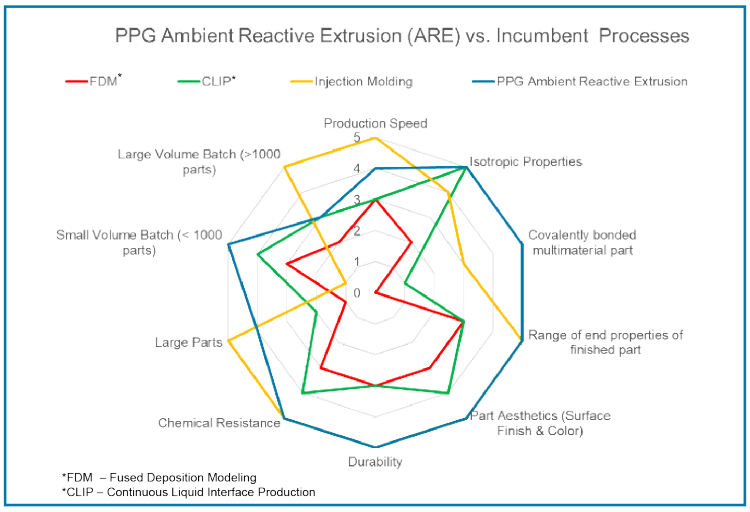
PPG Ambient Reactive Extrusion (ARE) 3D

PPG's Ambient Reactive Extrusion (ARE) Additive Manufacturing (AM) is an agile, reactive extrusion-based technology that expands the capabilities of currently manufacturing technologies with a broad selection of plastic materials and printing capabilities. This technology addresses shortcomings of current AM processes by providing multimaterial, covalently bonded, isotropic, end-use parts at scale and speeds suitable for aerospace, military and commercial applications. By merging PPG's decades of material development and color expertise with the advantages of ARE AM, PPG is positioned to enable transformational growth opportunities for innovative manufacturers at all stages of production.



Print Speed

Faster print speeds are highly sought after throughout the AM community. With faster print speeds, greater volumes of prints can be manufactured in less time which saves money and drives growth. PPG's ARE AM has demonstrated print speeds of at least 10 times faster than is possible with current thermoplastic AM processes. This increased print speed provides a potential pathway for current AM production opportunities to be made more efficiently and cost effectively.

Range of end properties

PPG's ARE AM is capable of producing parts with tailored properties for many different applications. This is due to the ability of PPG to directly tune the composition and the structure of the polymers as well as the resulting cross-linked polymer network. The parts can be tough, clear, pigmented, flexible, hard, electromagnetically active, or a combination of all of the above. The number of chemistry families and qualified materials available to hit target part properties make PPG's ARE AM technology stand out from the incumbent AM processes in the industry.

Multi-functional printing

The ability to utilize multiple material reservoirs with one print head allows PPG ARE AM to incorporate multiple materials covalently bonded into one print. By doing so, PPG's ARE AM capabilities are greatly enhanced, especially when compared to the multimaterial capabilities of other AM or injection molding processes available. For instance, a flexible material, a hard material, and a conductive material can be incorporated into the final print producing a wide range of unique material and print properties.

Color capability

PPG ARE AM materials can be easily pigmented and/or reinforced with fillers to produce ARE printable composites due to the liquid feedstocks. Therefore, by combining PPG's long history of color and pigment expertise with ARE AM, the color capabilities of PPG's ARE AM surpass those of other manufacturing processes.

Durability and chemical resistance

Inherently, thermoset materials typically outperform thermoplastics in durability and chemical resistance which makes PPG ARE AM products one of the most durable and chemically resistant on the market. Further, we can design our materials for specific properties such as UV-durability.

Scale range

The adaptability and speed of PPG ARE AM makes it suitable for scale. PPG ARE AM utilizes a diverse range of nozzle orifice diameters and flow rates. By increasing the nozzle diameter and flow rate, the only limiting factor to large part production is gantry speed. This enables PPG ARE AM to deposit greater volumes of material in a fraction of the time compared to traditional thermoplastic AM. By positioning ARE AM as an ambient extrusion-based technology, PPG ARE AM is not constrained by heat-creep prone heated extruders or vat and powder bed volume. This adaptability allows application specific gantries to be developed to address customer needs.

Resolution and Surface Finish

PPG ARE AM has developed a novel technique to preserve print resolution while enhancing print speed. This technique leverages the ability of ARE AM to print defined features with the ability to extrude liquid materials. Further, by utilizing ARE AM liquid feedstock technology, PPG's ARE AM can produce smooth surfaces without the appearance of print lines. Continued improvements to resolution, surface finish, and speed will be a focus of future development for ARE AM.

Sustainability

PPG's ARE AM takes waste reduction to the next level by producing end-use parts rather than prototype models. Differentiating PPG's ARE AM further, post-processing time is reduced due to the smooth surface finish after print. Additionally, the fact that a part produced via PPG's ARE AM cures ambiently and does not require any melting of thermoplastic filament or thermal-treatment makes the ARE AM process less energy intensive, especially at scale.

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