Private Company

In-line viscosity monitoring for real-time molecular weight assessment

Background

We are a global leader in packaging solutions, with a strong focus on innovation and sustainability across plastics and polymer processing. Polymer degradation refers to the breakdown of polymer chains, leading to a reduction in molecular weight. In polyester hydrolysis, heat and moisture break ester bonds, leading to inconsistent part quality. Recycled plastic degrades more readily than virgin plastic, due to contamination catalyzing degradation. Injection molding further degrades the plastic via heating (280–320°C), shear forces, and sudden pressure changes. In injection molding, polymer pellets are melted and mixed in a heated barrel, then injected through a hot runner and nozzle into a mold cavity. The material rapidly fills the mold, takes its final shape, and solidifies as it cools. Throughout this process, degradation can occur; particularly when the polymer experiences high shear stress. Currently, polymer degradation is not measured in real time during injection molding. The ability to monitor molecular weight at key points in the process would help to eliminate 'out-of-specification' products and reduce the need for rework. Since molecular weight correlates with viscosity at a given temperature, monitoring viscosity in real time could offer a way to detect degradation during injection molding.

What we're looking for

We are looking for in-line technologies to assess polymer molecular weight. These may include in-line rheometers, viscometers, or sensors using pressure differentials, sonic methods or other approaches. Proposed solutions should operate within the ~1.5-second injection window, which includes (1) injection acceleration, (2) injection speed plateau, and (3) injection deceleration into hold. The goal is to correlate in-line measurements of the polymer's properties to either molecular weight or solution intrinsic viscosity (SIV).

Solutions of interest include:

- Pressure differential sensors
- Rheometers (in-line)
- Sonic or ultrasonic sensors
- Viscometers (in-line)

Our must-have requirements are:

- Provides real-time measurements within the ~1.5-second injection window
- Adjusts for temperature fluctuations in the polymer melt
- Operates at high temperatures (280-320°C) and supports a design pressure of 2000 bar
- Integrates within the nozzle, which cannot exceed 17 cm in length (the nozzle tip accounts for 2 cm of that length)

Our nice-to-have's are:

- Correlation of molecular weight to solution intrinsic viscosity (SIV) for easier interpretation by polymer engineers

What's out of scope:

- Off-line equipment unless it is fed from the extruder and can operate autonomously
- Solutions requiring manual operation to transfer material
- Systems that cause additional polymer degradation

Acceptable technology readiness levels (TRL): Levels 1-9

1. Basic principles observed
2. Concept development
3. Experimental proof of concept
4. Validated in lab conditions
5. Validated in relevant environment
6. Demonstrated in relevant environment
7. Regulatory approval
8. Product in production
9. Product in market

What we can offer you

Eligible partnership models:

- Co-development
- Licensing
- Sponsored research
- Supply/purchase

Benefits:

Sponsored Research

We are willing to invest funding for high potential research & proof of concept (typically ranging from $25k-100k USD with potential follow-on) based on value proposition of technology proposed.

Expertise

Partners will have access to industry-leading experts in injection molding, polymer science, materials engineering, and manufacturing processes, providing guidance on best practices, product development, and testing.

Tools and Technologies

Partners may have access to our R&D centers, laboratory and pilot equipment for evaluating the performance of the technology.

Facilities and Services

Partners can potentially access our R&D pilot facilities, which include a variety of manufacturing platforms, analytical labs, and simulation capabilities to support data generation and performance evaluation.

Please contact the University of South Florida Technology Transfer office representative for submission – Karla Schramm at kschramm@usf.edu