

UNDERSTANDING AM FEEDSTOCK RECYCLABILITY USING SMALL ANGLE X-RAY SCATTERING

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Due to advances in additive manufacturing technologies, feedstocks that have been historically excluded from AM processing due to high temperature requirements are now gaining widespread use. Engineering thermoplastics such as PEEK and PEKK, both display high T_g and T_m , can now be used as feedstocks in both extrusion-type additive processes and selective laser sintering (SLS). The relatively recent emergence of these feedstocks has raised important manufacturing questions related to screening suitable feedstocks and the relationship between specific feedstocks and AM processing conditions. Traditional analytical tools have proven insufficient to fully elucidate and predict processing conditions because they fail to probe bulk morphological development. In this work we demonstrate the utility of small angle x-ray scattering (SAXS) as a tool to bridge the gap between AM feedstocks and processing conditions. Furthermore, this work has utilized SAXS to evaluate AM feedstock recyclability for SLS processes which require a significant amount of extraneous feedstock powder in the print bed. By tracking the morphological development of the unprinted feedstock powder in the bed, SAXS can be used to inform material reuse and recyclability determinations