

TITLE: PolyMethylMethAcrylate (PMMA) depolymerization

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On June 25th 2024, Trinseo inaugurated its PMMA depolymerization demonstration plant in Rho, Italy. PMMA depolymerization proceeds with a Thermolysis process through unzipping mechanism to give back its monomer MethylMethAcrylate (MMA) in high yields and purity. PMMA has a relatively low Ceiling temperature (Equilibrium temperature at which the polymerization is as likely as the depolymerization, or the temperature that nullify the Gibbs Free Energy). Therefore, depolymerization can take place at a lower temperature than for other polymers. What also favors the PMMA depolymerization is that the radical mechanism generates tertiary carbons radical chains. Once a radical has been produced several hundreds of monomer molecules can be generated at once through unzipping.

However, most of the PMMA scraps are made with comonomers. Those comonomers have been added in the formulation to improve some specific technical properties, such as temperature resistance, or solvent resistance... For example, PMMA grades used for injection and extrusion have usually a much lower molecular weight than PMMA grades made for cast sheets; and they need to survive to the heating cycle required by the injection and/or extrusion processes without starting to depolymerize. Acrylate co-monomers give this property to the PMMA materials, but it also means that these types of scraps will lead to lower mass yields during the depolymerization. Cast PMMA would then be more appropriate for depolymerization, but a large amount of this type of scrap is contaminated with PVC gaskets used in the cast process. The challenge in the thermolysis process is to generate a high quality monomer for closed loop applications, from a large diversity of applications (car tail lights, signage, construction domes and parapets, bath tubs, sound proof walls, green houses, signage, furniture...).