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Sustainable Engineering and Improved Recycling of PET for High-Value Applications: Transforming Linear PET to Lightly Branched PET with a Novel, Scalable Process CYNTHIA PIERRE, JOHN TORKELSON, Northwestern University — A major challenge for the most effective recycling of poly(ethylene terephthalate) concerns the fact that initial melt processing of PET into a product leads to substantial degradation of molecular weight. Thus, recycled PET has insufficient melt viscosity for reuse in high-value applications such as melt-blowing of PET bottles. Academic and industrial research has tried to remedy this situation by synthesis and use of "chain extenders" that can lead to branched PET (with higher melt viscosity than the linear recycled PET) via condensation reactions with functional groups on the PET. Here we show that simple processing of PET via solid-state shear pulverization (SSSP) leads to enhanced PET melt viscosity without need for chemical additives. We hypothesize that this branching results from low levels of chain scission accompanying SSSP, leading to formation of polymeric radicals that participate in chain transfer and combination reactions with other PET chains and thereby to in situ branch formation. The pulverized PET exhibits vastly enhanced crystallization kinetics, eliminating the need to employ cold crystallization to achieve maximum PET crystallinity. Results of SSSP processing of PET will be compared to results obtained with poly(butylene terephthalate).

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