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How do polymers degrade?

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Materials derived from agricultural products such as cellulose, starch, polylactide, etc. are more sustainable and environmentally benign than those derived from petroleum. However, applications of these polymers are limited by their processing properties, chemical and thermal stabilities. For example, polyethylene terephthalate fabrics last for many years under normal use conditions, but polylactide fabrics cannot due to chemical degradation. There are two primary mechanisms through which these polymers degrade: via hydrolysis and via oxidation. Both of these two mechanisms are related to combined factors such as monomer chemistry, chain configuration, chain mobility, crystallinity, and permeation to water and oxygen, and product geometry. In this talk, we will discuss how these materials degrade and how the degradation depends on these factors under application conditions. Both experimental studies and mathematical modeling will be presented.