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High temperature steam treatment of PEEK, PEKK, PBI, and their blends: A solid state NMR and IR spectroscopic study

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Abstract

Blends of polyaryletherketones (PAEK), such as polyetheretherketones (PEEK) and polyetherketoneketones (PEKK), with polybenzimidazole (PBI) are of commercial interest due to their improved high-temperature stability and wear properties. Regarding the PBI component, the origins of the properties that are generally thought to be disadvantageous in thermally or chemically aggressive environments are not well understood. The same accounts for the specifics of the interactions between the PBI and PAEK components in melt or dry blend systems. In this presentation, we focus on the morphological and molecular changes of PEEK-PBI and PEKK-PBI blends after treating them with liquid water and steam at elevated temperatures and pressures. The pure polymer components and the PAEK-PBI (60:40 and 50:50 wt%) blends are steam-treated at 149 °C (300 °F) and 316 °C (600 °F). The goal is to understand the chemical changes on the molecular scale that might take place upon high-temperature steam-treatment and to examine the reversibility of moisture uptake of this material when exposed to water or steam. In this contribution, IR and solid-state NMR spectroscopy are used to study chemical or morphological transformations of the polymers. The changes detectable by ^{13}C CP/MAS upon steam-treatment and their reversibility will be discussed. Interactions and reactions of the water with the functional groups of the polymer components have been studied using deuterated water in combination with IR, ^{2}H and ^{15}N MAS, and ^{1}H wideline NMR spectroscopy.

Biography

Jacqueline Pope is a fifth year Ph.D. candidate in the Department of Chemistry at Texas A&M University in College Station, TX. She is an active member of the Texas A&M University Student Chapter of the Society of Plastics Engineers (SPE) and was president of this chapter for the 2012-2013 school year. She is also actively involved in the Women in Science and Engineering (WISE) organization at Texas A&M.