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Dedication to Otto Vogl

While at DuPont, prior to his academic career at the University of Massachusetts, my professor and PhD co-research advisor, Otto Vogl, started investigating polyether-based ionomers, with his colleague, Ken Martin. The synthesis was carried out by mixing trioxane (the cyclic trimer of formaldehyde) with ethyl glycidate in the gas phase, polymerizing the mixture cationically with boron trifluoride initiator and then hydrolyzing the polymeric ester to the corresponding polyoxymethylene copolymer with pendant carboxylate groups.

At UMass, for my PhD thesis, we expanded on this gas phase bulk polymerization to include also polymers synthesized by solution polymerization. Then in collaboration with my other research advisor, Bill MacKnight, we characterized the infrared, calorimetric, dielectric and dynamic mechanical properties of the trioxane homopolymer, its copolymers and terpolymers with ethyl glycidate and 1,3-dioxolane and the corresponding sodium, lithium and cesium ionomers. I still have fond memories of my early graduate school years when I synthesized these polymers in our “waterworks” lab in the old Goessman chemistry building, alongside several hard working fellow PhD students, including Russ Gaudiana. In addition to my thesis, I co-authored four papers describing the results of our research (1–4).

I was one of a number of investigators associated with Professor Vogl who determined ethyl glycidate to be a fairly unreactive monomer to ring opening cationic homo- and copolymerization. As a result we were only able to synthesize either medium molecular weight copolymers with low percent of ethyl glycidate incorporation or low molecular weight copolymers with higher levels of incorporation. Even with organometallic initiators, which enabled the synthesis of high molecular weight copolymers with ethyl glycidate, this monomer did not homopolymerize to any significant extent and could only be incorporated up to 5 mole percent in the copolymers.

Under Otto Vogl’s mentorship, I realized the importance of utilizing polymer reactions to design products with

enhanced properties. Two years ago, we selected another epoxy ester to design a robust protective overcoat for inkjet media. Unlike ethyl glycidate, however, this highly reactive epoxy ester, glycidyl methacrylate, was incorporated into the polymer backbone, not via ring opening polymerization of the epoxy ring, but by addition to the double bond of the methacrylate monomer through a low temperature free radical chain emulsion polymerization. Subsequently, the reactive pendant epoxy ring was utilized to lightly crosslink the final polymeric film, without the formation of undesirable volatile byproducts. This was realized by a heat activated ring opening addition reaction with pendant carboxylic acid groups, incorporated into the same polymer chain via copolymerization of the glycidyl methacrylate with methacrylic acid, ethyl methacrylate and butyl methacrylate.

My esteemed Kodak colleagues and I are delighted to submit a co-authored paper, investigating the accelerated physical aging properties of a polymer incorporating this reactive epoxy ester, using temperature-modulated differential calorimetry, in honor of Professor Vogl’s 80th birthday, as an expression of my personal gratitude for his unique impact on my professional career and for his lifetime contributions as an educator and an innovator to the field of Polymer Science and Engineering.

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