DESIGN AND SYNTHESIS OF A HIGH POLARITY MONOMER FOR ELABORATION INTO A FIELD RESPONSIVE MATERIAL FOR WOUND FILM CAPACITORS

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ABSTRACT

Pulse power capacitors are under intense consideration by the U.S. Navy as a power source for all-electric missiles. Polycarbonate has been used for decades in wound film capacitors owing to its excellent ability to form consistent, well-behaved films of moderate dielectric permittivity and good breakdown strength. Newer materials with fast relaxation times are required to meet energy density specifications for military requirements such as in rail guns. Urea-related molecules have high dipoles which make them respond to externally applied electric fields. We have designed a molecule containing a key imidazolidinone unit for subsequent polymerization and dielectric film testing. Several synthetic routes were considered for synthesis of this material and will be described. The successful synthesis ultimately employed a recently-published variation on the well-known Goldberg reaction as modified by Buchwald. Obstacles initially encountered included deprotection which led to a modification in the choice of protective group. Molecular characterization data by proton nuclear resonance spectroscopy confirmed the expected structure.