STUDY OF POLY(ETHYLENE-CO-METHACRYLIC ACID) AS HEALING AGENT IN EPOXY

Isabel Mertel[1], Alexandra Pokhlestova[1], Frank Balle[1], Fernando Fernandes[2], Fábio Santos da Silva[2], Evans Paiva da Costa Ferreira[3], Ana Paula Cysne Barbosa[3], Jose Daniel Diniz Melo[3]

[1] Institute of Materials Science and Engineering, University of Kaiserslautern, Kaiserslautern, Germany

[2] Embraer, São José dos Campos – SP, Brazil

[3] Department for Materials Engineering, Federal University of Rio Grande do Norte, Natal, Brazil

Abstract: Microcracks may affect the structural integrity of the composite material, shorten the life of the structural component and most importantly could compromise its safety. In response to that, self-healing materials have been intensely investigated in recent years, as a means to repair invisible microcracks. Self-healing materials have the ability to recover their load transferring ability after damage and this can be triggered after activation through a specific stimulus or occur autonomously. These materials are expected to contribute to safety and durability without the high costs for active monitoring or external repair. In this work, the feasibility of poly(ethylene-co-methacrylic acid) (EMAA) as healing agent in a high performance epoxy was studied, as well as the effects of the addition of this thermoplastic healing agent to epoxy. Samples with and without thermoplastic were investigated by Fourier Transform Infrared (FTIR) spectroscopy, dynamic mechanical analysis (DMA), scanning electron microscopy (SEM) and field emission gun – scanning electron microscopy (FEG-SEM). Results revealed a well-connected interface between EMAA and epoxy matrix, which was likely to be promoted by chemical and physical interactions. Chemical reactions that are important for the self-healing ability of EMAA were believed to be observed. DMA results showed no significant reduction of the glass transition temperature of the epoxy with EMAA as compared to the unmodified epoxy.

Keywords: self-healing, epoxy, thermoplastic, EMAA, poly(ethylene-co-methacrylic acid)