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Environmentally Friendly Methods for Polymeric Paint Removal

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As part of an on-going project aiming at the development of novel technologies for the removal of paint from metal substrates, experimental results on two methods with potentially low environmental impact for both civilian and military applications, are reported. The first method involves the use of ultrasonics to degrade/decrosslink and, hence, easily remove modified polymeric paints selected from the categories of acrylics, urethanes and epoxies. Product characterization methods were adopted from our earlier work on the extruder devulcanization of elastomeric materials through the use of ultrasonics. The second method involves the enzymatic degradation of acrylate and urethane based coatings through the use of appropriate enzyme families, followed by the use of ultrasonics. In the first method, the reported experimental results focus on model, clear protective polymeric coatings modified through the use of additives that would upon heating: a) expand several-fold, and therefore adversely affect the coating integrity, or, b) release appropriate chemicals that would migrate to the coating/substrate interface to minimize adhesion. In all cases, easiness of paint removal was assessed after subsequent ultrasonic treatment. Specific additives used in this first method, at concentrations not exceeding 15% by wt., included: a) hydrocarbon filled polymeric microspheres that expand 4-5 folds upon heating at temperatures ranging from 140 to 180 ^{o}C and b) polymeric microcapsules containing silicone–like additives that were broken through the action of ultrasonics and released their content. Preliminary results on enzymatic degradation of acrylic and urethane coatings focused on the identification of optimum degradation conditions in terms of buffer composition and pH and the follow-up of the progress of the reaction through FTIR spectroscopy, microscopy, SEM surface analysis and changes in polymer molecular weight. Optimum biodegradation conditions are reported.