250b Environmentally Friendly Polymers and Composites for Military Applications

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Liquid resins used for molding composite structures are a significant source of volatile organic compounds (VOC) and hazardous air pollutant (HAP) emissions. One method of reducing styrene emissions from vinyl ester (VE) resins is to replace some or all of the styrene with fatty acid-based monomers. Fatty acid monomers are ideal candidates because they are inexpensive, have low volatilities, and promote global sustainability because they are derived from renewable resources. VE resins with no more than 20 wt% styrene were prepared using methacrylate terminated fatty acids. The viscosities of these resins were below 500 cP, allowing the use of vacuum assisted resin transfer molding for composite production. Composite panels were made from these resins using E-glass at ~0.4 volume fraction. Although the flexural properties were slightly less than that of Dow Derakane 411-350, the industry standard, the fracture properties of the fatty acid-based vinyl esters were higher. Therefore, fatty acid monomers can be used to produce affordable low VOC/HAP vinyl ester resins without a loss in performance.