High recovery stress obtained in benzoxazine-epoxy shape memory polymers reinforced with carbon fiber
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Abstract: Shape memory polymers (SMPs) are materials that possess an ability to recover their original shape upon receiving an external stimulation. There are many advantages of SMPs compared to shape memory metal alloy such as high percentage of strain. However, SMPs have rather low modulus and strength especially in the rubbery state. This results in a rather low recovery stress of SMPs. To overcome this weakness, woven carbon fiber (CF) is used to reinforce benzoxazine (BA-a)-epoxy binary systems to improve their modulus and strength as well as their recovery stress. The contents of the fiber were varied from 0-80 vol%. Shape fixity, shape recovery ratio and recovery stress of composites were then investigated by a universal testing machine equipped with an environmental chamber. The results revealed that the SMPCs showed high percentage of shape fixity greater than 90% and shape recovery ratio of close to 100% with increasing amount of the matrix resin. The appropriate content of CF is 40 vol%. In addition, recovery stress of the composites reinforced with CF increased with increasing carbon fiber content with value about 7 times higher than that of the composites without carbon fibers (i.e. 3.4 MPa).

Keywords: Shape memory polymers; Benzoxazine; Epoxy; Carbon fibers