# The Effect of Graphite Additives on Magnetization, Resistivity and Electrical Conductivity of Magnetorheological Plastomer


## ABSTRACT

Common sensors in many applications are in the form of rigid devices that can react according to external stimuli. However, a magnetorheological plastomer (MRP) can offer a new type of sensing capability, as it is flexible in shape, soft, and responsive to an external magnetic field. In this study, graphite (Gr) particles are introduced into an MRP as an additive, to investigate the advantages of its electrical properties in MRPs, such as conductivity, which is absolutely required in a potential sensor. As a first step to achieve this, MRP samples containing carbonyl iron particles (CIPs) and various amounts of of Gr, from 0 to 10 wt.%, are prepared, and their magnetic-field-dependent electrical properties are experimentally evaluated. After the morphological aspect of Gr–MRP is characterized using environmental scanning electron microscopy (ESEM), the magnetic properties of MRP and Gr–MRP are evaluated via a vibrating sample magnetometer (VSM). The resistivities of the Gr–MRP samples are then tested under various applied magnetic flux densities, showing that the resistivity of Gr–MRP decreases with increasing of Gr content up to 10 wt.%. In addition, the electrical conductivity is tested using a test rig, showing that the conductivity increases as the amount of Gr additive increases, up to 10 wt.%. The conductivity of 10 wt.% Gr–MRP is found to be highest, at 178.06% higher than the Gr–MRP with 6 wt.%, for a magnetic flux density of 400 mT. It is observed that with the addition of Gr, the conductivity properties are improved with increases in the magnetic flux density, which could contribute to the potential usefulness of these materials as sensing detection devices.