Effect of pretreatment on magnetic nanoparticles growth on graphene surface and electromagnetic shielding performance in electroless plating

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Graphene has attracted considerable attention for electromagnetic interference shielding due to high conductivity induced from pi-pi conjugation of sp2 carbons. Moreover, magnetic particles can be easily grown on the surface of graphene because graphene is a suitable nanosubstrate for growing nanoparticles. The magnetic/graphene hybrid materials are considered appropriate materials for excellent electromagnetic shielding/absorption performance. However, reduction process by heat treatment at hydrogen atmosphere is needed to obtain magnetic metal nanoparticles, increasing the cost of the materials.

Electroless plating method is a practical method for metal coating on surface of materials. As the coating conditions change, metal in the form of nanoparticles can also be grown by electroless plating. However, there is no systematic study of growth of nanoparticles on graphene by electroless plating, so there is no guideline on how to grow nanoparticles on graphene.

In this work, we synthesize magnetic/graphene hybrid materials using electroless deposition under various pretreatment conditions. The hybrid materials are analyzed by SEM, TEM, XRD, and VSM to examine the chemical and magnetic properties. We observe sensitization and activation process significantly influence the magnetic property of the hybrid materials. To obtain high saturated magnetization of the magnetic/graphene hybrid materials, sensitization and activation should be performed at an optimized condition. Electromagnetic shielding/absorption properties were investigated using composite film of hybrid materials and polymer. This study will give a guideline to prepare magnetic nanoparticles/graphene hybrid materials without heat treatment process.