Study on Surface Coating Materials for Enhancing Adhesion in Electroless Plating

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Introduction

❑ **GHz electromagnetic (EM) wave**
- Increasingly applied in various application fields due to the saturation of lower frequency bands

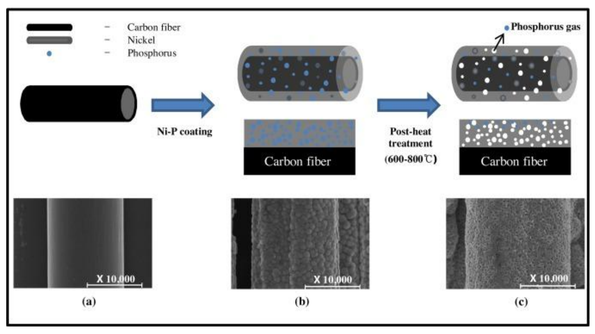
❑ **The problems of the devices**
- Harmful electromagnetic radiation
- Malfunction of instruments by noise
- Deterioration of signal quality due to electromagnetic interference (EMI)

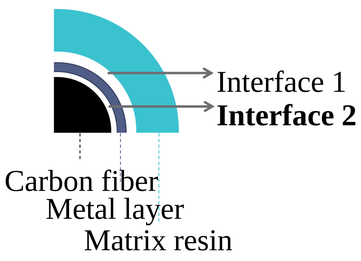
High performance EMI shielding materials based on fiber reinforcements

Metal plated fibers

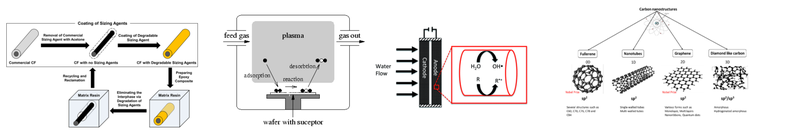
- Low density
- High electrical conductivity
- High specific strength
- Excellent corrosion resistance
- Low thermal expansion rate
- Good workability

▪ EMI SE enhancement





Interfacial adhesion enhancement

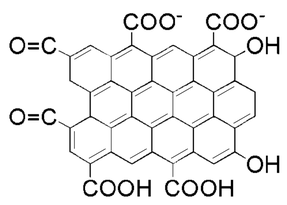


Enhancement of interfacial adhesion between fiber and metal layer to strengthen composite materials

Experimental

➢ Materials

Edge-selectively oxidized graphene (EOG)



▪ *Specificity of EOG*
1. Maintain sp^2 bonding
2. High electrical conductivity
3. Adsorption with Pd/Sn particles
4. High specific surface
5. High dispersion

A.Edge selectively oxidized graphene coating

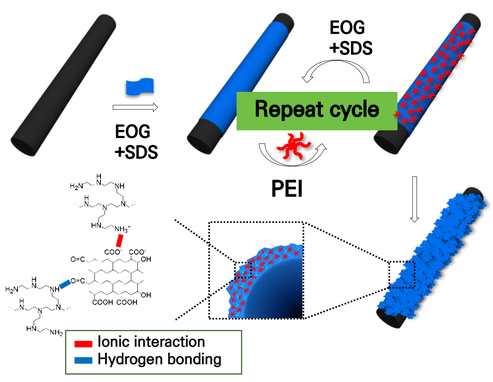
Morphology analysis
Crystal property analysis

B.Electroless Ni-P plating

Interfacial adhesion evaluation

Electromagnetic interference shielding effectiveness

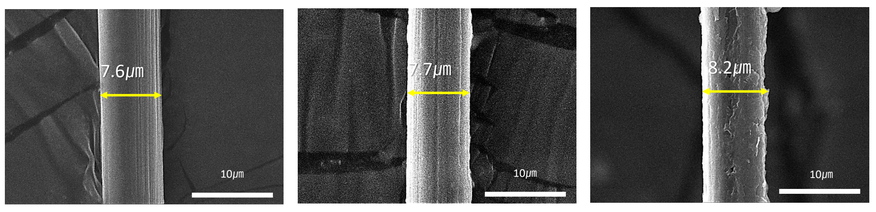
➢ EOG coating process on carbon fiber



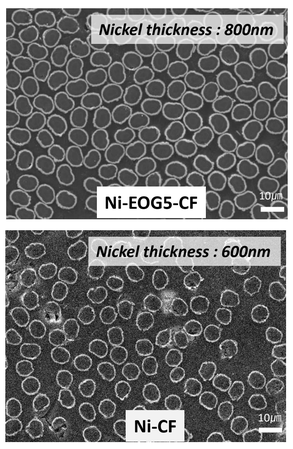
Condition	Notation
De-sized carbon fiber	D-CF
Electroless Nickel-plated on pristine carbon fiber	Ni-CF
Repeat EOG coating *n* times on carbon fiber	EOGn-CF
Electroless Nickel plated on EOG coated carbon fiber	Ni-EOG-CF

Results and Discussion

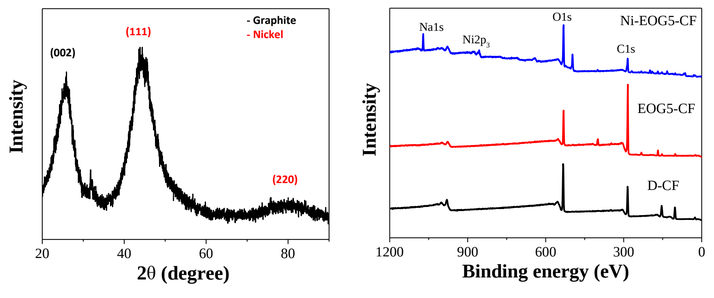
➢ Surface of carbon fibers after coating and plating



Improve roughness of the CF surface

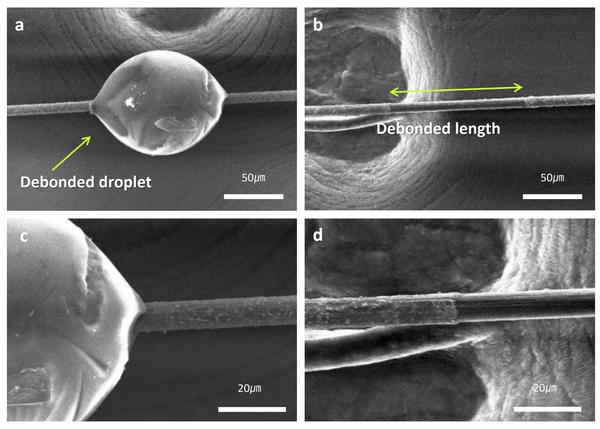


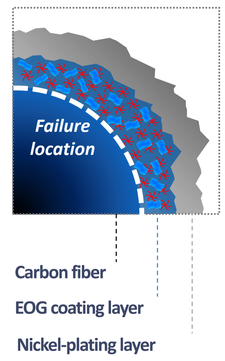
➢ XRD and XPS analysis of carbon fibers



SPECIMENS	O/C RATIO	Ni/C RATIO
D-CF	0.67	-
EOG5-CF	0.21	-
Ni-CF	0.72	0.001
Ni-EOG5-CF	1.12	0.090

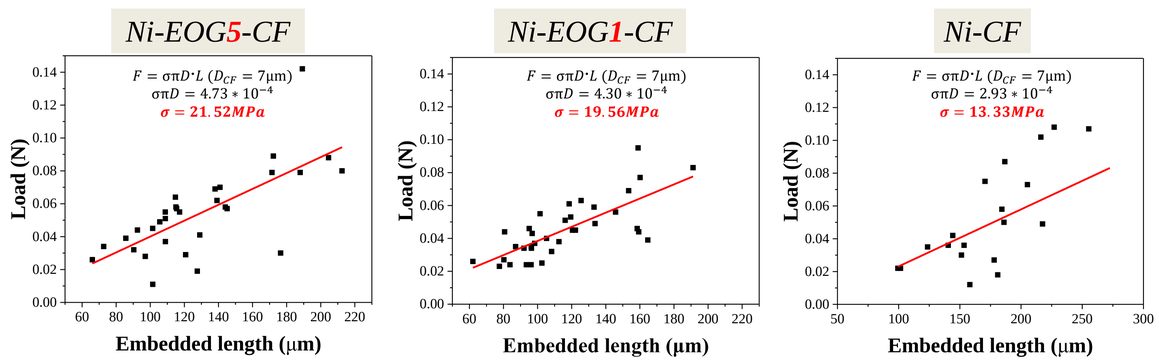
➢ Microdroplet test of Ni-EOG5-CF with epoxy

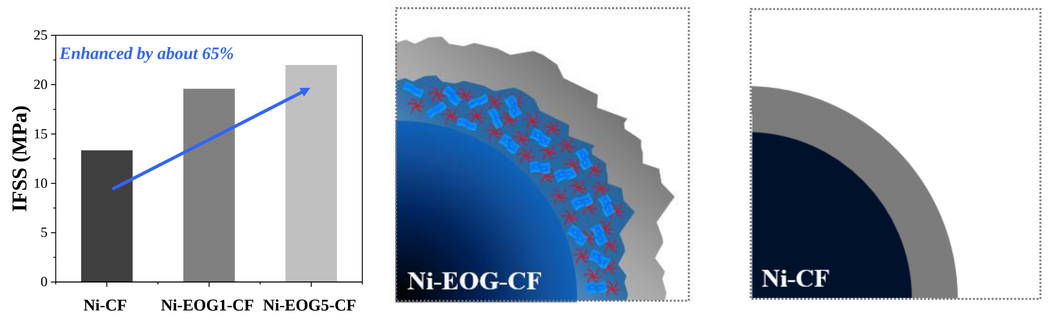




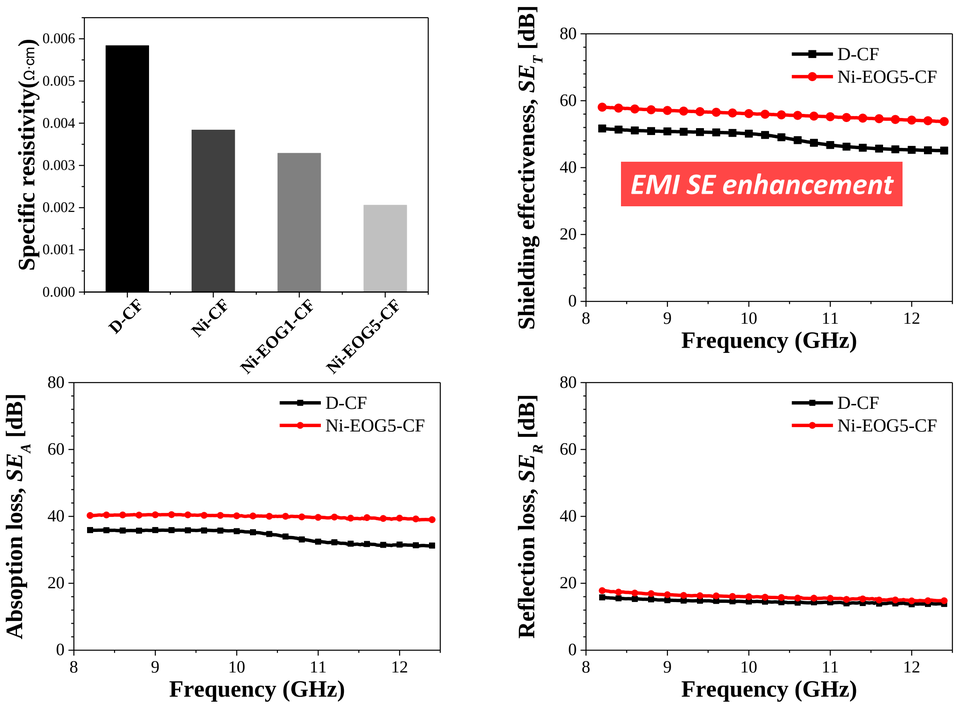
Shear deformation occurs at the interface between the carbon fiber and the graphene coating layer

➢ Interfacial strength of plated metal





➢ EMI shielding performance



Summary

➢The effect of surface treatment using edge selectively oxidized graphene to improve the interfacial adhesion strength between a CF and a nickel-plated layer of CF reinforced composite material with EMI shielding effect through electroless nickel plating was investigated.

➢The interfacial adhesion strength of the specimen repeated 5 times with EOG coating was increased by 64.82 % .

➢Since EOG coating and nickel-plating CF composite has EMI shielding performance of 58 dB in X-band region, it has significant potential as an EMI shielding material.