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Nickel-containing magnetoceramics from water vapor assisted pyrolysis of polysiloxane and nickel 2,4-pentanedionate

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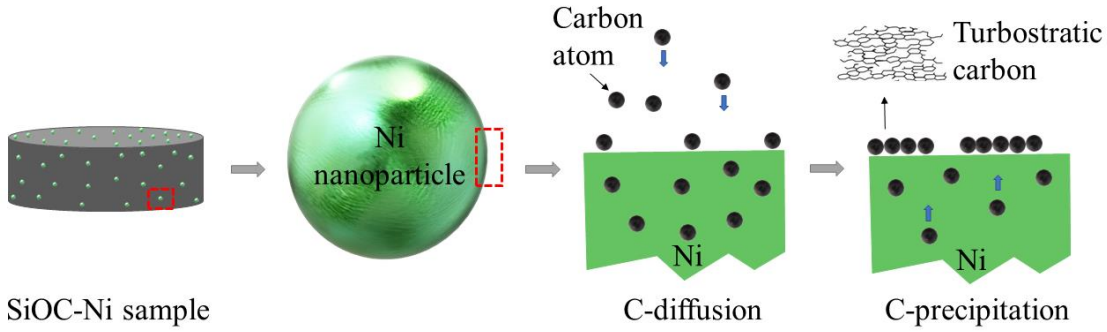
Abstract

In this presentation, novel ferromagnetic Ni-containing silicon oxycarbide (SiOC–Ni) was successfully fabricated from a base polysiloxane (PSO) with the addition of nickel 2,4-pentanedionate. The resultant SiOC–Ni nanocomposite consists of in situ formed Ni nanocrystallites with a small amount of NiO uniformly dispersed in the amorphous SiOC matrix, and the corresponding nanocrystallite size increases with the increase of the pyrolysis temperature. The formation of nickel silicides (Ni_xSi_y) is completely suppressed by the effect of water vapor during the pyrolysis. The fundamental phase evolution process and mechanisms are explained. In an argon atmosphere, the SiOC–Ni materials pyrolyzed at 900°C are stable up to 1000°C with less than 6 wt% weight loss; they exhibit desirable electrical conductivity up to ~900°C with the highest electrical conductivity at ~247 S/m. This series of SiOC–Ni materials also demonstrates exciting ferromagnetic behaviors. Their new semiconducting behavior with soft ferromagnetism presents promising application potentials for magnetic sensors, transformers, actuators, etc.



Reference: Yang N, Gao M, Li J, Lu K. Nickel-containing magnetoceramics from water vapor-assisted pyrolysis of polysiloxane and nickel 2,4-pentanedionate. J Am Ceram Soc. 2020;103:145–157. https://doi.org/10.1111/jace.16738

Biography

Ni is a third-year Ph.D. student in the MSE department working with prof. Kathy Lu. Her research is focused on the fundamental understanding and functionality of polymer derived ceramic – silicon oxycarbide. She spent her first year of graduate study at the University of Florida at Gainesville, before transfer to Virginia Tech for continuing her graduate life. She plans to graduate in the Winter of 2020.