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In situ AlN/Al_2O_3 composite powder formation using dextrose-assisted carbothermal reduction

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Aluminum Nitride (AlN) as a stoichiometric ceramic structure is best known for their thermal conductivities, insulation performance and high range optical transparency from UV to IR, low thermal expansion and thus thermal shock resistance. High mechanical properties alongside with their corrosion resistance up to 1200 °C also nominate this material as one of the functional options in different engineering fields. One of the challenging issues in these industrial applications is the high cost of powder preparation and sintering process. For the improvement of physical, mechanical and oxidation behavior of final piece, the purification of grain boundaries, also cost reduction, the presence of different additional phases is proposed and examined. In this work, the relatively low-cost method of carbothermal nitridation is used for the *in situ* preparation of AlN/Al_2O_3 powder. Urea, aluminum nitrate nonahydrate and dextrose are used as the starting materials. One-pot reaction in less than 10 minutes, following by carbothermal nitridation in tube furnace is used for complete crystallization of as- prepared mixture. AlN crystals are formed after nitridation at 1400 °C-1500 °C. The phase percentage of Alpha and gamma will increase by decarburization temperature rising from 700 °C to 1000 °C. In fact, by the post-decarburization process, alumina phase percentage is selective. On the other side, by nitridation of the center core of combustion process, the gamma alumina is eliminated, and high temperature stable C_3N_4 phase was formed instead. Phase and morphology characterization of the mixed powders were investigated by TEM and SEM. Also, the wettability of the powder is studied as well. TG/DTA and FT-IR Spectroscopy are used for the mechanism studies of the synthesis process.

Biography

Hajar Ghanbari has her expertise in carbonaceous and 2D materials, ceramic composites and laser-assisted synthesis of nanomaterials. She has proposed her explosion model on the laser-assisted synthesis of graphene in organic solvents in 2014. She has joined Iran University of Science and Technology, Faculty of Metallurgy and Materials Engineering, Ceramics Division since September 2016 and established a research group focusing on modern ceramics.

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