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Antibacterial activity of intermetallic NixMgy and NiO–MgO phases in nickel-magnesium oxide nanocomposites

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Abstract: This work focuses on Ni–Mg metallic nanomaterials and NiO–MgO composites, especially on their antibacterial activity against Escherichia coli (E. coli (G-)) and Staphylococcus aureus (S. aureus (G+)) in relation with their size and structure. They are generated by impregnation of nickel formate, followed by either calcination (T = 100–600 °C) or gamma-irradiation at room temperature. In samples prepared by calcination at temperatures T ? 300 °C or irradiation, the structural study by XRD and HRTEM reveals the presence of nanoscaled Ni–Mg intermetallic phases: NiMg2, Ni2Mg and NiMg6.33 (2–4 nm diameter) and magnesium hydroxide Mg(OH)2. At T > 300 °C, only the NiO–MgO solid solution is formed. Bare MgO and NiO–MgO nanoparticles exhibit a bacterial activity only against E. coli and S. aureus, respectively. In contrast, the Ni–Mg intermetallic phases of high specific area, that are present in irradiated (T = 20 °C) or calcined (T ? 300 °C) samples, exhibit a significant antibacterial activity against both E. coli and S. aureus.

Keywords : Antibacterial Activity, Gamma radiolysis, intermetallic Compounds, NiO–MgO, Ni–Mg