

# Antibacterial activity of intermetallic Ni<sub>x</sub>Mg<sub>y</sub> 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 ( $T = 100\text{--}600\text{ }^{\circ}\text{C}$ ) or gamma-irradiation at room temperature. In samples prepared by calcination at temperatures  $T \geq 300\text{ }^{\circ}\text{C}$  or irradiation, the structural study by XRD and HRTEM reveals the presence of nanoscaled Ni–Mg intermetallic phases: NiMg<sub>2</sub>, Ni<sub>2</sub>Mg and NiMg<sub>6.33</sub> (2–4 nm diameter) and magnesium hydroxide Mg(OH)<sub>2</sub>. At  $T > 300\text{ }^{\circ}\text{C}$ , 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 ( $T = 20\text{ }^{\circ}\text{C}$ ) or calcined ( $T \geq 300\text{ }^{\circ}\text{C}$ ) samples, exhibit a significant antibacterial activity against both *E. coli* and *S. aureus*.

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