

# Early Stage Phase Formation in Steel-Ni-Mg Alloy System During Laser Brazing Process by FactSage

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## **Abstract**

From the thermodynamics point of view, using FactSage thermochemical software, the stability of the precipitated phases along steel-Ni-Mg alloy (fusion zone) interface during laser brazing process was evaluated. The Equilib module in FactSage is capable of adequately describing thermodynamic properties of the fusion zone (activities of different components in the fusion zone) in the steel-Ni interlayer-Mg alloy system at different laser brazing temperatures used, assuming very local equilibrium. The activity-temperature-composition relationships of possible formed intermetallic phases along the interface of steel-Ni interlayer-AZ92 magnesium alloy in the temperature range of 600-1100 °C were estimated. The results presented a contribution to a better knowledge of phase formation in the interface of dissimilar joints during laser brazing process. The results showed that addition of a Ni interlayer between the steel and the Mg alloy during laser brazing process causes the formation of the AlNi and Mg<sub>2</sub>Ni intermetallic compounds along the interface; however, other Al-Ni intermetallic compounds, such as Al<sub>3</sub>Ni or Al<sub>3</sub>Ni<sub>2</sub> were not stable to precipitate. In addition, laser brazing of Ni electro-plated steel to AZ31B-H24 magnesium alloy using AZ92 magnesium alloy filler wire confirmed the formation of AlNi and Mg<sub>2</sub>Ni along steel-fusion zone interface. The theoretical and experimental results confirmed occurring of metallurgical bonding between Ni electro-plated steel and Mg alloy during laser brazing process with formation of AlNi intermetallic compound.