**Pool Boiling Enhancement with High Entropy Oxides (HEO)**

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**Abstract:**

This study explores the potential of high entropy oxides (HEOs) as pool boiling additives in deionized (DI) water to enhance boiling heat transfer. Experiments were conducted using spinel [(Al₁/₆Co₁/₆Cr₁/₆Fe₁/₆Mn₁/₆Ni₁/₆)₃O₄], perovskite [La(Co₀.₂Cr₀.₂Fe₀.₂Mn₀.₂Ni₀.₂)O₃, Y(Co₀.₂Cr₀.₂Fe₀.₂Mn₀.₂Ni₀.₂)O₃], and rock salt [(Mg₀.₂Co₀.₂Ni₀.₂Li₀.₂Zn₀.₂)O] structured HEOs. A significant enhancement in critical heat flux (CHF) and heat transfer coefficient (HTC) was observed. Specifically, 0.05 wt% La(Co₀.₂Cr₀.₂Fe₀.₂Mn₀.₂Ni₀.₂)O₃ yielded a 66.1% increase in CHF, while 0.05 wt% Y(Co₀.₂Cr₀.₂Fe₀.₂Mn₀.₂Ni₀.₂)O₃ improved CHF by 62.5% and HTC by 136.5% compared to the DI water baseline on plain copper surfaces. To investigate dispersion behavior and long-term colloidal stability, a 15-day ultrasonication-based dispersion test was conducted in DI water. The study identified key mechanisms for effective dispersion, including de-agglomeration, formation of hydroxyl functional groups, and electrostatic repulsion. These findings support the potential of HEOs as scalable additives for enhancing thermal fluids in pool boiling applications.

**Experimental setup:**

**Diagram of a machine with a device

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**Fig 1:** Schematic of the pool boiling setup along with thermocouple location for temperature measurements.

**Results:**

A graph of different types of heat and water

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**Fig 2:** Boiling performance of HEO dispersions compared to DI water (a) heat flux vs wall super heat, (b) HTC vs heat flux, and (c) CHF vs maximum HTC (*h*max).