Corrosion and Heat Transfer Fluids in Thermal Energy Storage for Concentrating Solar Power

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Recently, the utilisation of renewable energies has increased as they represent the most viable alternative to fossil fuels. Solar energy technologies become increasingly significant, particularly concentrating solar power (CSP), a highly promising technology for converting solar thermal energy into electricity, offering the potential for energy storage after-sun hours. These technologies include sensible and latent heat, using heat transfer fluids (HTF) to absorb and store the energy received.

HTFs can be composed of a variety of materials, including thermal oils, water, air, and molten salts (MS). Currently, Solar Salt is the most utilized MS as HTF in CSP plants. Higher temperature MS are constantly searched to meet high energy density, efficiency requirements, and better thermal stability than solar salt. The use of high temperatures in CSP is however quite challenging, considering a series of criteria: (a) the allowed temperature working ranges, as wide as possible, which requires low melting points and high decomposition temperatures, ensuring thermal/chemical stability of the salts across the range; (b) high heat transfer rates are required; (c) the interaction of construction materials with the salts, the corrosion effect and mitigation surface treatments are needed to prevent corrosion in static and dynamic conditions.

An overview of different HTFs, their thermophysical properties, and the corrosivity for a wide range of metallic materials, including the experimental work developed in the Laboratory of Materials and Coatings of LNEG in static and dynamic conditions and at the Molecular Thermophysics and Fluid Engineering Group of CQE (FCUL) in the last years.

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