Recycled Material for Sensible Heat Based Thermal Energy Storage to be Used in Concentrated Solar Thermal Power Plants

Current technologies of concentrated solar power plants (CSP) are under extensive industrial development but still suffer from lack of adapted thermal energy storage (TES) materials and systems. In the case of extended storage (some hours), thousands of tonnes of materials are concerned leading to high investment cost, high energy and GHG contents and major conflicts of use. In this paper, recycled industrial ceramics made by vitrification of asbestos containing wastes (ACW) are studied as candidates to be used as sensible TES material. The material presents no hazard, no environmental impact, good thermophysical properties (λ = 1.4 W m⁻¹ K⁻¹; C_p = 1025 J kg⁻¹ K⁻¹; ρ = 3100 kg m⁻³) and at very low investment cost. Thanks to the vitrification process of the wastes, the obtained ceramics is very stable up to 1200°C and can be directly manufactured with the desired shape. The vitrified ACW can be used as TES material for all kinds of the CSP processes (from medium up to high concentration levels) with properties in the same range than other available materials but with lower cost and without conflict of use. The proposed approach leads also to sustainable TES allowing a pay back of the energy needed for the initial waste treatment. Furthermore, this new use of the matter can enhance the waste treatment industry instead of landfill disposal.

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