

In-depth Induction Heating of Large Steel Slabs by Means of DC Saturating Field Produced by SC Coils

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Abstract — The feasibility of an innovative in-depth AC induction heating method for large steel slabs is investigated. Beside the AC field, which induces the heating currents, a large DC magnetic field is also applied which brings the material to saturation. Due to the saturation the permeability is reduced by orders of magnitude and the penetration depth is drastically increased, thus making it possible a much faster and uniform heating. In order to produce the field needed for the saturation of common steels work piece, lossless DC superconducting magnets need to be employed. The possible layout of the AC induction heater which employs magnetic saturation (Saturated AC Induction Heater) is discussed. The concept design of the superconducting magnet needed is carried out based on present state of the art superconducting materials. The performance of the saturated AC induction heater is investigated numerically and compared with the case of no magnetic saturation.

Keywords (Index Terms) — Induction heating, temperature control, steel slab, saturation magnetization, superconducting magnets, MgB₂.