Forging Residual Heat Exploitation Feasibility for Annealing Treatments in Space Restricted Lay-Outs

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Abstract. Taking advantage of the residual heat in forged components right after forging, by means of loading them directly into a continuous heat treatment furnace, is a known strategy to improve energy efficiency. Besides energy savings, several side benefits are also achieved by this strategy, such as the capability of treating parts as individuals instead of being elements of a batch, reducing the resources destined to logistics and shortening delivery lead-time. Nevertheless, it is not always possible to deploy such an in-line heat treatment process due to part geometry, requirements or forging line lay-out. A theoretical-practical study for a continuous forging and annealing process design is presented for a case where the available length for the annealing furnace is the limiting restriction. The combination of time-temperature-transformation diagrams, continuous-cooling-transformation curves, cooling rate simulations and lab and pilot-plant scale heat treatments is proved as an effective approach to successfully determine the feasibility of designing an in-line heat treatment that satisfies the imposed size restrictions.