Research on Optimization Design of Anti oxidation Skin Particle Blockage and Tube Explosion in Overheating Tube Bend Structure of Power Station Boiler

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Abstract Based on a systematic investigation and reflection on the service damage status and structural design methods of power plant boiler superheaters, five different structural models of superheater tubes were designed. The numerical simulation method of steam-particle two-phase flow was used to study the influence of different superheated tube structures on the transport characteristics of oxide scale particles and pipeline pressure loss characteristics under low load steam parameters, and the application comparison was carried out in the calculation of the tube screen of the superheater. Through single tube calculations, it was found that under different amounts of oxide scale particle shedding, the bottom inclined structure and combined bend tube structure maintained a transport efficiency of over 90% for particles, which was superior to the other three structures. Compared to the prototype superheated tube, the total pressure loss coefficient of the combined bend structure decreased by 0.42%, and the flow rate increased by 5.18%. The total pressure loss coefficient of the bottom inclined structure increased by 0.24%, and the flow rate decreased by 3.26%. Two preferred superheater tube structures were assembled onto the superheater tube screen, and it was found that the transport efficiency of oxide scale particles above 1000 μm was 2% -6.3% higher for the combined bend superheater tube than for the bottom inclined superheater tube. In the blocked state, the maximum steam flow velocity of the combined bend superheater tube was 28.2% higher than that of the bottom inclined superheater tube. It was concluded that the combined bend tube structure has good applicability in both the superheater design stage and the cutting and modification stage of the prototype superheater local burst tube bundle. The research results provide a new idea for solving the problem of overheating and tube

bursting in superheaters, and also provide reference for subsequent optimization design of superheaters.

Keywords Superheater; Tube screen ; Bend structure; Oxide particle; Numerical simulation

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