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Adaptations in diffusion treatments enable the tool life time enhancement of forging dies

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The economic viability of hot forging processes for the effective production of safety relevant parts with excellent mechanical properties depends on the occurring wear of the tools, which limits the service lifetime.
By modifying the surface zone layer it is possible to create a material resistance against thermal softening, which is provoking plastic deformation and pronounced abrasive wear. On the other hand, intensely nitrided surfaces often show an increased crack sensitivity and therefore the chipping of material is possible. New approaches in adapted processes will minimize the disadvantages and keep the high technological potential in reducing thermally caused damages.
State-of-the-art techniques are enabling localized treatments by applying pastes or other coverage in order to prevent certain sensitive areas from nitrogen diffusion. This leads to the new approach of structuring the surface with differently designed patterns generating a surface with ductile zones beneath nitrided ones. This influences the formation and propagation of cracks under thermal shock conditions.
To evaluate the advantages, an accurate system of testing rigs for the abstraction of the thermal shock conditions proves the technological potential of the development. This includes the constructed flexible testing unit with a heated punch and adjustable quenching conditions and serial forging tests. Special analytical methods characterize the crack sensitivity of the modified surface zone layers.
With an optimized crack behavior of the surface zone layer, the efficiency of the industrial production process is enhanced due to the stabilized and increased service lifetime of the tools.

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