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Hot stamping of ultra high strength steels: A key technology for lightweight automotive design

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Abstracts

By the automotive industries, current developments of car body concept have been focused on enhancing crash safety and reducing weight of vehicle. Therefore, Advanced High Strength (AHS) steels have been increasingly applied instead of common low alloy steels. Although, manufacturing processes of such steel sheets with higher strength encountered difficulties concerning higher forming force, limited formability, part accuracy and die wear. Hot stamping or press hardening has been developed for producing automotive components with extraordinary high strength. By the hot stamping, sheet metal must be heated up to a temperature higher than the austenitization temperature (A_{c3}) before or after forming and subsequently quenched in water-cooled dies. A fully martensitic microstructure occurs in the steel sheet and causes an increase of tensile strength up to 1500 MPa. Present studies exhibited that boron alloy steel with specific coating depending on applied process, heating system, blank transfer, dies with cooling ducts, die materials and subsequent processing like cutting and joining must be carefully taken into account. In addition, manufacturing of a single part with tailored properties can be hereby achieved by controlling cooling rate in defined areas of the component or by reducing the heating temperature to be lower than the A_{c3} temperature. The hot stamping has shown the great potential for further innovations in the field of hot sheet metal forming and increasing application of high strength steels. However, basic knowledge of physical phenomena during the hot stamping is the important key factor for a successful process design.

Biography



Dr. Vitoon Uthaisangsuk is an assistant professor and course director of postgraduate studies at the Department of Mechanical Engineering, King Mongkut's University of Technology Thonburi. He was a Thai government scholarship holder. He graduated from RWTH Aachen University, Germany with a diploma and PhD in Mechanical and Metallurgical Engineering. His main research interests are advanced high strength steels, mechanical metallurgy, fracture and damage mechanics as well as Finite Element analysis. His current research works include investigation of manufacturing, mechanical and forming behavior of high strength steel sheets for automotive parts.

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