# A microstructure based design for applications of advanced high strength steels

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Recently, global warming and environmental aspects have become one of the most important issues in every industries and societies. Therefore, innovative technologies, more efficient energy and material consumption, which could lead to decreased $CO_2$ emission, are strongly required. For this purpose, advanced high strength (AHS) steels have been extensively developed and become a great solution for lightweight design. These steel sheets are widely applied in several engineering structures, especially, in car body parts. More than 50% of the total mass of body structure in new vehicles consists of the AHS, since they provide superior mechanical properties like stiffness, strength on the one hand and great forming behaviour and energy absorption on the other hand. In other fields such as oil/gas and construction industries, other types of AHS steels with excellent combination of strength and toughness have been also applied, in which enhanced structural and safety integrity can be realized and less material is needed at the same time. The AHS steels contain multiple microstructure constituents, which have different individual mechanical behaviors. The mechanical properties and fracture occurrence of steels are strongly governed by their microstructure characteristics like type, size, fraction and spatial distribution of various existing phases, which in turn are directly affected by the manufacturing process. To effectively produce, efficiently design and utilize the AHS steels a precise relationship between microstructures, processing routes, operation load conditions and their mechanical responses must be well established. Therefore, the proposed micromechanics based approach is an advantageous tool, in which the complex nature of steels and advanced multi-scale modeling techniques are incorporated. By this means, the optimum design, production and application of AHS steels is allowed. Some application examples of the microstructure based method and results with regard to pipeline steels, spot welding, complex forming processes and crashworthiness will be shown.