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Feasibility analysis of Ceramic cutting tools for manufacturing Austempered Ductile Iron (ADI)

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Abstract. The Austempered Ductile Iron (ADI) is a ferrous cast material that presents high design flexibility, elevated resistance against weight, good tenacity, fatigue, and wear resistance, and additionally, cost-effective solution. Besides, the use of these material is found in many industrial sectors as the automotive or critical safety. However, this material presents many challenges to be manufactured in terms of low machinability compared with cast materials. The most common technique used is reducing manufacturing steps before performing the heat treatment, what it is not possible with tough dimensional requirements and complex geometries. Ceramic cutting tools are presented as a possible solution to obtain a more productive process manufacturing ADI materials. Their main characteristic consists of being hard and resistant at high temperatures but with low tenacity. Therefore, their performance is optimal applied to continuous processes as turning. This work presents a feasibility analysis of turning ADI material using ceramic inserts and a comparison with the commonly used of carbide inserts. For this purpose, an experimental campaign is performed to obtain optimal cutting parameters. Finally, cutting forces are analysed. Finally, these cutting tools perform a dry manufacturing process, aligned with an eco-friendly solution.