

Effects of environmental impact based on alternative materials and process selection in automotive component design

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Abstrak

Recent literature in automotive research indicates that studies of the environmental impact mostly concern metal-based components. Environmental effects are mainly analyzed using “environmental performance indicators” and “life cycle assessment” techniques. Therefore, a knowledge gap in the field of studying automotive plastic components should be conducted based on analyzing material and manufacturing processes selection at the design stage. The research is focused on a plastic component previously unexplored and analyzed using tools that have not been employed for this application. A computer-aided tool was used to model the part and its associated sustainability function was used to analyze its environmental impact. The component was analyzed using different materials and manufacturing processes, then redesigned to be more ergonomic. The improved component design was manufactured using rapid prototyping and a consumer preference survey was conducted to determine which component was preferred. The research found that by changing the material to high-density polyethylene there would be approximately a 30% reduction in carbon footprint, 24% reduction in air acidification, 26% reduction in water eutrophication and 15% reduction in total energy consumption. Injection molding is found to be the most sustainable manufacturing process.