Modelling and Optimization of the Wear rate, Compressive Strength and Hardness of a Composite Brake Pad

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Abstract

A composite brake pad of periwinkle shell, phenolic resin and other additives was developed. The mixture design experiment was adopted using the Design Expert 10.0 software 2017 version and the sample composites were produced using compression molding. Mathematical models of the wear rate, compressive strength and hardness values were developed and validated. The models for the wear rate and compressive strength fitted best with the quartic response model while that of the hardness suited best with quartic and linear models. Comparison of the models with experimental results graphically showed high degree of correlation. An optimized formulation with an objective of minimization of the wear rate and maximization compressive strength and hardness value was determined at 50, 30 and 20% of periwinkle shell powder (filler), phenolic resin (matrix) and additives respectively. Thus the mathematical model can be used to predict the wear rate, compressive strength and hardness value of the experimental design adopted.

Keywords: periwinkle shell; composite brake pad; quartic mathematical model; wear rate; compressive strength; hardness value; mixture design
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