The Effect of Dimpled Surfaces on the Aerodynamics of Pinewood Derby Cars

Abstract

The concept of a golf ball utilizes its unique, dimpled surface texture to make it fast and more aerodynamic. The purpose of this study, which was conducted by the student researcher, was to see how implementing dimples on the surface of a Pinewood Derby car (a small wooden car with four plastic wheels) would affect the amount of drag force against it. A golf ball uses dimples on its surface that help it travel faster and farther than a normal smooth ball by reducing its drag force against it, and the student researcher questioned whether the effect is similar if not the same for other shapes, specifically Pinewood Derby cars. The student researcher hypothesized there would be a significant difference between the time it took a Pinewood Derby car with a smooth surface to travel a Pinewood Derby track and the time it took a Pinewood Derby car with a dimpled surface to travel a Pinewood Derby track. This was accomplished by assembling two identical Pinewood Derby cars that had the same dimensions. An equal amount of clay was distributed among the surface of the cars, and dimples were implemented in one of them. The mass of each car was measured after each construction step to ensure that it remained the same between both cars. The student researcher then tested the speeds of the cars as they raced side-by-side along an official Pinewood Derby track. This was done by timing how long it took each car to travel the length of the track. The times for the car with the smooth surface showed to be higher than the times of the car with the dimpled surface. The experiment done by the student researcher confirmed that there was a significant difference between the time it took a Pinewood Derby car with a smooth surface to travel a Pinewood Derby track and the time it took a Pinewood Derby car with a dimpled surface to travel a Pinewood Derby track. The car with the dimpled surface was faster in reaching the finish line. Ultimately, it was evident that dimpled surfaces do affect the drag force acting on Pinewood Derby cars by reducing this force against the car and making the cars more aerodynamic. This finding can be a gateway to future studies and applications in the real world. With the fuel economy in its current and detrimental position, new ways to improve fuel efficiency in cars in any way will help. Dimples have the potential to improve gas mileage and help cars run more efficiently, consequently improving the economy.