

# A cover for the single-person pedal-powered vehicle

## 1. Introduction

With the development of environmentally friendly cities, transportation tools harmless to nature have received widespread attention. One example is the single-person pedal-powered vehicle (SPPPV)<sup>1</sup>. This type of vehicle is similar to a common bicycle, but its driving mechanical process is different, saving effort and providing faster speeds while ensuring safety<sup>1</sup>.

Like ordinary bicycles, the SPPPV must have a cover to protect riders from harsh weather conditions. However, since the speed of SPPPV is high and the weight is low compared to common vehicles, covers for SPPPV should be lightweight, have a strong structure, and be waterproof.<sup>2</sup> So far, few materials possess all of these characteristics. One material proposed in the 2000s is the high-nitrogen polymer,<sup>3</sup> which is waterproof and light. Unfortunately, due to its complicated manufacturing process, it cannot be commercialized. Another material is the single-fiber stacked film (SFSF)<sup>4</sup>, which is also limited because of its poor waterproof property.

The limitation of traditional polymers lead to metallic doping. Recent studies<sup>5,6</sup> have shown that doping metallic elements such as silicon and iron can significantly improve the atomic bond energy and shrink the atomic spacing, leading to a large tensile strength and a waterproof surface. However, the polymer mass increases with doping. In contrast, the Jackson-Lee effect<sup>7</sup> show that metallic atoms in organic periodical materials can experience an effective atomic interaction, lowering the atomic energy by up to 90%.

In the present research, our group noticed this interesting phenomenon, which can be easily extended to polymer systems. We assumes that carefully tuning the doped metal ratio can change the mass of the polymer, resulting in mass lowering. By calculating and experimenting with the properties of different ratio metal-doped polymer, we obtain a metal-doped single-layer stacked polymer film, which inherits the strong, waterproof properties of doped polymers, the light mass of Jackson-Lee polymers, and the cheap manufacturing cost of SFSF. This material, named “light metal polymer” can be the perfect candidate for SPPPV covers.

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