A Study on the Mechanical Properties of Waste Plastic/Waste Stone Powder/Fly Ash Composite Materials

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폐플라스틱/폐석분/플라이애쉬 복합재료의 기계적 특성에 관한 연구

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Abstract

Plastic is a polymer material composed of long carbon chains. Due to its advantages such as light weight, excellent flexibility, and low production costs, the plastic is widely used in various aspects of daily life. Generally speaking, waste plastics can be divided into industrial and urban sources. Industrial plastics are generally pollution-free and have uniform properties, making them suitable for recycling and reuse in low-grade plastic products. Urban waste plastics usually contain a large amount of impurities, and multiple cleaning processes are required for reuse. In addition, the common waste plastics in life are mainly composed of low-density polyethylene (LDPE), high-density polyethylene (HDPE), polypropylene (PP), polyethylene terephthalate (PET), polyethylene terephthalate (PET) and polystyrene (PS). Polyethylene (HDPE and LDPE) and PP are the most widely used plastics, accounting for about 70% of the total plastic. They are commonly used in fields such as plastic bags, storage boxes, plastic bottles, pipe and cable insulation. PVC is often used as an alternative to rubber in pipes, cable insulation, car seat covers, and certain applications. PET is another popular polymer widely used in beverage bottles, fibers, and films. Moreover, PP, PS and PE are commonly used in the packaging industry. However, most plastics are extracted from fossil fuels and have strong biodegradation resistance. If the reuse rate of waste plastics is not improved, it will inevitably cause serious environmental pollution. On the other hand, the waste stone powder mainly occurs in the mining and processing of waste concrete and granite at construction sites. Most of the waste stone produced by waste concrete is classified as recycled aggregate for recycling, while the waste stone and waste stone powder produced in the mining or processing of granite are only partially recycled by recycled aggregate, The rest are illegally landfilled or abandoned without authorization, which will lead to certain environmental pollution. Therefore, how to reuse these industrial by-products to reduce environmental pollution is of great significance for building a green and healthy society. The final waste is fly ash, which mainly comes from solid waste discharged from coal-fired power plants. According to relevant data, the global production of coal-fired waste is as high as 780 million metric tons (Mt). The largest output country is China (118 Mt), followed by North America (118 Mt), India (105 Mt), Europa (52.6 Mt) and Africa (31.1 Mt). The accumulation of large amounts of fly ash not only consumes a large amount of space, but also causes serious pollution to air, water, and soil. Therefore, it is necessary to improve the reuse rate of fly ash.

In this study, in order to expand the utilization of waste plastics, waste stone powder and fly ash as adsorption additives were mixed in a certain weight ratio and then thermoplastic formed. In addition, the types and contents of heavy metals released from thermoplastic composites were also analyzed. The morphology and the crystal structure were investigated by In order to improve the reuse value of various wastes such as waste plastics, waste stone powder and fly ash, these wastes were uniformly mixed and stirred according to different kinds of mixing ratios, and finally a variety of composite materials were prepared through injection molding technology. The mechanical properties and internal structure of these composites have been investigated through universal testing machine (UTM), scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS), X-ray diffraction patterns (XRD) and fourier transform infrared spectroscopy (FT-IR).

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