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Steel furnace slag aggregate for railway ballast: assessment of abrasion evolution by close-range photogrammetry

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Abstract

Electric Arc Furnace steel slag aggregate has potential for wider application in transport infrastructures. However, the use of steel slag aggregate in the railway ballast layer, as an alternative to natural high quality crushed rock, is still restricted in some countries. This is not consistent with the current sustainable construction paradigm. To demonstrate the potential of this material, in this study the authors characterized its morphology and performance, carrying out quantitative analyses on the abrasion and 3D morphology evolution of particles submitted to micro-Deval testing. The slag particles showed higher angularity and surface texture indices than a natural granite used as reference; retained these characteristics longer; and yielded comparable or lower surface wear. These findings support the potential use of slag aggregate as an alternative to railway ballast material.

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Keywords: Railway ballast; Industrial by-product; Electric Arc Furnace steel slag aggregate; Particle morphology; Abrasion; Photogrammetry

1. Introduction

When properly processed, Electric Arc Furnace steel slag aggregate – a by-product of metallurgic industry – has high potential for application as an artificial aggregate in support layers of transport infrastructures (Gomes Correia *et al.*, 2012). Although there is evidence about the environmental and economic benefits of its application in railway ballast layer, as an alternative to natural aggregate of crushed rock (Delgado *et al.*, 2021), this application is still limited throughout the world. The strength and morphology of the particles that make up the ballast layer are fundamental aspects that influence its performance (Athanassiadis *et al.*, 2014). Most technical specifications (CEN, 2002; AREMA, 2010) state that morphology characterization is performed following well-established and widely

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