

## Microstructural Changes during Regeneration of Plaster of Paris Using Discarded Moulds

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### Abstract

Recycling discarded plaster of Paris (POP) molds has gained increasing importance due to environmental concerns and the need for sustainable utilization of gypsum resources. Previous studies have primarily focused on the recycling methods and improvements in macroscopic properties. This study examines the generation of spent POP molds, emphasizing microstructural changes induced by controlled thermal treatment followed by mechanical reprocessing to obtain regenerated calcium sulfate hemihydrate. The elemental composition of commercial and recycled POP was analyzed using Energy Dispersive X-ray Spectroscopy (EDX). Particle size distribution was evaluated using sieve analysis and laser-based particle size measurement techniques. Mechanical performance was assessed through compressive and flexural strength tests conducted using a Universal Testing Machine (UTM). Micro-structural characteristics, crystal morphology associated with  $\beta$ -calcium sulfate hemihydrate, were examined using Scanning Electron Microscopy (SEM). Functional properties were evaluated through water absorption tests, determination of moisture content using a moisture analyzer, and assessment of setting behavior, setting kinetics were characterized by monitoring temperature evolution during hydration, with maximum exothermic temperature serving as an indicator of material reactivity. Microstructural investigations revealed that mainly irregular-shaped particles were present in the used molds, while the treated material contains elongated particles. Investigations revealed that the micro-structural characteristics and physical and chemical properties of the resulting product confirmed the standard requirements of commercial-grade Plaster of Paris and complied with the specifications, despite a minor reduction in mechanical strength.

**Keywords:** *discarded molds; microstructure; morphology; plaster of Paris; regeneration*