POLYMERIC COATED REACTIVE GRAINS AS INTELLIGENT ADDITION IN CEMENTITIOUS COMPOSITES FOR GENERATING THE SELF-HEALING EFFECT

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Rezumat. *Cerințele de implementare stringentă a criteriilor dezvoltării durabile, pe fondul poluării masive, a necesității conservării resurselor naturale și de protejare a mediului, imprimă necesitatea dezvoltării unor materiale de construcții cu performanțe superioare, atât din punct de vedere al materiei prime utilizate și a costurilor de producție, cât și a caracteristicilor fizico-mecanice și de durabilitate pe durata de viață a structurii. Astfel, stimularea caracterului intrinsec de autovindecare autogenă a compozitelor cu matrici pe bază de ciment, pentru creșterea durabilității și duratei de viață simultan reducerii acțiunilor de reparație și mentenanță, reprezintă o direcție de cercetare inovativă, actuală și de anvergură mondială. Prezenta lucrare prezintă direcțiile preliminare, conceptuale și de dezvoltare aplicativă, a unui adaos inteligent de granule reactive cu încapsulare polimerică, destinat materialelor cementoase, respectiv optimizării durabilității acestora prin stimularea potențialului de hidratare continuă, specific acestora.*

Abstract. *The requirements for the stringent implementation of sustainability criteria for development, considering the worldwide context of massive pollution, the need to preserve the natural resources and the urge for environmental protection emphasize the drive for developing high-performance building materials, both in terms of raw materials used and low production costs, as well as related to their physical-mechanical and durability characteristics along the lifespan of the structure where used. Consequently, stimulating the intrinsic self-healing ability of cementitious composites, aiming both, the increase of durability and structural lifespan expansion with simultaneous reduction of*

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repair and maintenance activities, represents an innovative, highly explored, contemporary global research direction. This paper presents the preliminary direction concerning the theoretical investigation and the applicative development of an intelligent addition of reactive grains with polymeric encapsulation, for cementitious materials, namely for optimizing their durability by stimulating the long-term continuous hydration.

Keywords: reactive grains, cementitious composites, Self-Healing effect; continuous hydration, sustainability

1. Introduction

Cracks occurring inevitably in concrete, mortar and cementitious composites represent the damage produced within their micro-structure; therefore, the healing, respectively the self -healing of cement-based materials is entirely related to crack closing (sealing), this phenomena leading to the desired, complete or partial recovery, with respect to the initial state.

It is a fact that concrete and generally cement-based materials represent the most widely used building materials at the global level, experiencing a continuous development and expansion of their use, especially since the Portland cement was discovered in the mid-19th century. Subjected to unavoidable time degrading behavior, the usual design life for a typical concrete structure ranges from fifty to a hundred years; the expected service life is kept functional by the means of consistent activities regarding the building monitoring and repair intervention when the case, which determines worldwide impressive consumption of resources (material and energetic, human labor, economic, etc.). For example, specific evaluations provided a few years ago showed the annual US required budget for maintenance and repair clearly exceeds the one for new structures [1]. The Institution of Civil Engineers of Cardiff University report [2] reveals a similar situation in UK by the means of a relevant, economic (billions of pounds) ratio between repair and maintenance works for concrete structures and new construction works, referring to the Great Britain status for the 1997-2007 period (see Figure 1). Another issue is related to the durability of concrete infrastructure repair: there are evaluations performed in US revealing that approximately 50% of repairs require re-intervention and supplementary efforts for re-repair, which generates an unsustainable character of this approach [3]. Consequently, a change of perspective was considered.

Recently, the ability of concrete structures to repair itself, with reduced or even without help provided by men, has gained a lot of ground in the research communities all around the globe. First scientific observation regarding the intrinsic ability of concrete cracks to seal by themselves, namely Autogenous Healing, was attributed to the French Academy of Sciences, in 1836 [4].