Accepted Manuscript

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PII:	S1386-1425(18)30356-1
DOI:	doi:10.1016/j.saa.2018.04.049
Reference:	SAA 16006
To appear in:	*Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*
Received date:	31 December 2017
Revised date:	20 April 2018
Accepted date:	23 April 2018

Please cite this article as: Karolina Kaczmarska, Beata Grabowska, Artur Bobrowski, Sylwia Cukrowicz , Effects of curing conditions on the structure of sodium carboxymethyl starch/mineral matrix system: FT-IR investigation. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Saa(2017), doi:10.1016/j.saa.2018.04.049

Title

Effects of curing conditions on the structure of sodium carboxymethyl starch/mineral matrix system: FT-IR investigation

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Keywords:

Moulding sands; Polymer binders; Modified starch; Spectroscopy; Crosslinking; Microwave radiation; Conventional heating

Abstract

Strength properties of the microwave cured moulding sands containing binders in a form of the aqueous solution of sodium carboxymethyl starch (CMS-Na) are higher than the same molding composition cured by conventional heating. Finding the reason of this effect was the main purpose in this study. Structural changes caused by both physical curing methods of moulding sands systems containing mineral matrix (silica sand) and polymer water-soluble binder (CMS-Na) were compared. It was shown, by means of the FT-IR spectroscopic studies, that the activation of the polar groups in the polymer macromolecules structure as well as silanol groups on the mineral matrix surfaces was occurred in the microwave radiation. Binding process in microwave-cured samples was an effect of formation the hydrogen bonds network between hydroxyl and/or carbonyl groups present in polymer and silanol groups present in mineral matrix. FT-IR studies of structural changes in conventional and microwave cured samples confirm that participation of hydrogen bonds is greater after microwave curing than conventional heating.

1 Introduction

In foundries, in the production cycle are used substances of organic, inorganic and mineral origin, which ensure obtaining durable molds, and giving the possibility of making castings taking into account the reduction of their defects. The selection of materials and proper curing methods are two important aspects of the production of molds and cores in the technology of molding sands [1–3]. However, some of these materials during application in the technological process could be a serious harmful for workers and the environment - also due to the used method of curing. Therefore, many research teams focus their attention on modification of well-known materials or on the preparation of new substances towards the development of environmentally friendly foundry technologies [4–7].