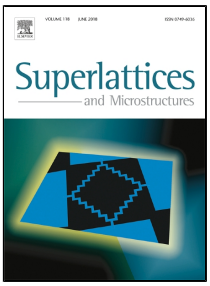
Accepted Manuscript



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PII:	S0749-6036(18)31229-1
DOI:	10.1016/j.spmi.2018.06.030
Reference:	YSPMI 5765
To appear in:	*Superlattices and Microstructures*
Received Date:	14 June 2018
Accepted Date:	15 June 2018

Please cite this article as: Matin Ashurov, Elena Eremina, Tatyana Laptinskaya, Sergey Klimonsky, Self-assembly of polystyrene microspheres into two-level hierarchical structures, *Superlattices and Microstructures* (2018), doi: 10.1016/j.spmi.2018.06.030

Self-assembly of polystyrene microspheres into two-level hierarchical structures

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Abstract

Two-level arrays of colloidal particles have been obtained using the method based on an intermittent, ‘‘stick–slip’’ motion of the meniscus during colloidal suspension evaporation. The ethanol suspension of monodisperse polystyrene microspheres of about 1 μm in size was prepared by emulsifier-free emulsion polymerization of styrene with potassium persulphate as an initiator. The resulting structures consist of parallel monolayer stripes of deposited microspheres, repeated with a period of 140-150 μm, and empty spaces between them. The microspheres are packed into a hexagonal structure inside the stripes. Laser diffraction patterns have been demonstrated for both levels of ordering, i.e., for the hexagonal structure at the first level and for the parallel stripes at the second level.

Keywords: Self-assembly; Polystyrene microspheres; Intermittent meniscus motion; Monolayer stripes; Laser diffraction.

1. Introduction

Fabrication of complex patterned structures in an exactly controlled manner is achieved by top-down lithography methods [1, 2]. Although such approaches are quite effective, the use of bottom-up self-assembly processes is strongly desired to complement them as the required structure sizes become less than a micron [3]. Bottom-up approaches for structures with larger period are also possible [4-8]. Recently it was shown [8] that diffraction gratings with the period of the order of 150-300 μm can be obtained by deposition of colloidal microspheres if an