Accepted Manuscript

Crystallization behavior of $(GeTe_4)_x(GaTe_3)_{100-x}$ glasses for far-infrared optics applications

Roman Svoboda, Daniela Brandová

PII: S0925-8388(18)33030-5

DOI: 10.1016/j.jallcom.2018.08.150

Reference: JALCOM 47238

To appear in: *Journal of Alloys and Compounds*

Received Date: 26 April 2018

Revised Date: 27 July 2018

Accepted Date: 16 August 2018

Please cite this article as: R. Svoboda, D. Brandová, Crystallization behavior of $(GeTe_4)_x(GaTe_3)_{100-x}$ glasses for far-infrared optics applications, *Journal of Alloys and Compounds* (2018), doi: 10.1016/j.jallcom.2018.08.150.

Crystallization behavior of $(GeTe_4)_x(GaTe_3)_{100-x}$ glasses for far-infrared optics applications

Roman Svoboda[*1], Daniela Brandová[1]

[1]*Department of Physical Chemistry, Faculty of Chemical Technology, University of Pardubice, Studentská 573, 532 10 Pardubice, Czech Republic.*

Abstract

Differential scanning calorimetry (DSC), X-ray diffraction (XRD), infrared microscopy and Raman spectroscopy were used to study the crystallization behavior of the $(GeTe_4)_x(GaTe_3)_{100-x}$ glasses for far-infrared optics. Two independent overlapping crystallization processes were found – the initial surface-located precipitation of hexagonal Te and Ga_2Te_5 phases, followed by formation of the rhombohedral GeTe phase. The initial precipitation process, and in particular the formation of the Ga_2Te_5 phase, was found to be catalyzed by presence of mechanically induced defects. Finely powdered materials with higher $GaTe_3$ content also exhibited more pronounced separation of the two crystallization sub-processes. Glass stability of the prepared glasses was evaluated in terms of the Hrubý criterion - the $(GeTe_4)_{86}(GaTe_3)_{14}$ composition was found to be the most stable and most resilient to the negative crystallization-enhancing influence of structure defects. Pros and cons of the compositional evolution of the crystallization behaviour (determined via full kinetic description of the involved crystallization sub-processes and kinetic prediction of the crystallization behavior) were discussed with regard to the ceramics and glass-ceramics applications. Glasses with low $GaTe_3$ content appear to be most suitable for preparation of fully ceramic materials, whereas glasses with high $GaTe_3$ content seem to be most suitable for the glass-ceramics applications.

Keywords: Ge-Ga-Te glasses; crystallization kinetics; DSC; XRD; glass-ceramics

[*] Corresponding author: Tel.: +420 466 037 346 E-mail address: roman.svoboda@upce.cz