

The synthesis and thermal stability of $\text{In}_3\text{Cu}_2\text{VO}_9$.

M. Bosacka¹, E. Filipek

¹West Pomeranian University of Technology, Szczecin; Department of Inorganic and Analytical Chemistry; Al. Piastow 42; 71-065 Szczecin
bossm@zut.edu.pl

The $\text{In}_3\text{Cu}_2\text{VO}_9$ compound is formed in the three-component system of indium, cuprum and vanadium oxides and it is known in the literature [1,2]. Papers reported only on structural [1] and magnetic [2] data of $\text{In}_3\text{Cu}_2\text{VO}_9$. It crystallises in hexagonal system and belongs to space group $P6_3/mmc$ [1]. The compound was obtained at 900°C under flow of O_2 in Pt crucible from $\text{In}_2\text{O}_3/\text{CuO}/\text{V}_2\text{O}_5$ mixture (molar ratio 3:4:1) [1]. The compound $\text{In}_3\text{Cu}_2\text{VO}_9$ is interesting due to their magnetic structure [1,2]. Optical studies of $\text{In}_3\text{Cu}_2\text{VO}_9$ compounds revealed that the ground state orbital is $3z^2-r^2$ with an appreciable admixture of Cu 4s orbital of Cu 2p which is exceptional for the cuprates [1].

Within the presented work the synthesis of the $\text{In}_3\text{Cu}_2\text{VO}_9$ compound was carried out by using mixtures of $\text{In}_2\text{O}_3/\text{CuO}/\text{V}_2\text{O}_5$, $\text{Cu}_2\text{In}_2\text{O}_5/\text{InVO}_4$ and $\text{Cu}_5\text{V}_2\text{O}_{10}/\text{In}_2\text{O}_3$ that were heated in several stages in the atmosphere of air or argon at temperatures not exceeding 700°C . These mixtures, after homogenizing and shaping into pellets, were heated under the following conditions: 600°C (8h) + 650°C (8h) + 690°C (8h × 2). The obtained compound has been studied by XRD, DTA, SEM and IR methods. Figure presents a SEM image of $\text{In}_3\text{Cu}_2\text{VO}_9$ compound.

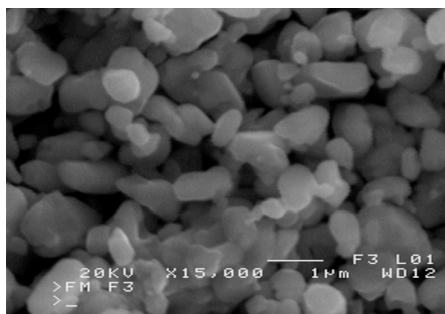
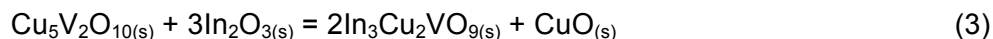
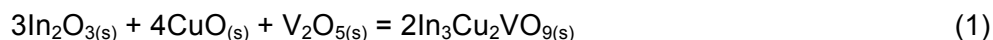


Fig. SEM image of $\text{In}_3\text{Cu}_2\text{VO}_9$

Powder diffraction patterns of all samples recorded after the last heating stage contained a set of diffraction lines belonging to XRD characteristic of $\text{In}_3\text{Cu}_2\text{VO}_9$ compound. Thus it can be concluded that as a result of the solid-state reactions in the atmosphere of air or argon:



the compound of the formula $\text{In}_3\text{Cu}_2\text{VO}_9$ was obtained.

$\text{In}_3\text{Cu}_2\text{VO}_9$ is red sort of colour. As follows from the XRD pattern of powdered $\text{In}_3\text{Cu}_2\text{VO}_9$ obtained in this study by solid-state reaction and the indexing of this diffractogram, the compound obtained is identical with the compound obtained at 900°C under flow of O_2 and described in [1,2]. The melting temperature of $\text{In}_3\text{Cu}_2\text{VO}_9$, read as the onset of an endothermic effect recorded in the DTA curve, amounts to $950 \pm 5^\circ\text{C}$. On the base of XRD analysis of the $\text{In}_3\text{Cu}_2\text{VO}_9$ sample heated for 2 hours at 970°C and next instantly cooled it was found that this compound melts incongruently with a deposition of In_2O_3 crystals.

[1] V. Kataev, A. Möller, U. Löw, W. Jung, N. Schittner, M. Kriener, A. Freimuth, J. Magn. Magn. Mater. **290-291** (2005) 310-3.

[2] K. K. Iyer, T. Basu, A. K. Singh, K. Mukherjee, P. L. Paulose, E. V. Sampathkumaran, AIP Conf. Proc. **1536** (2013) 1049-50