EXTENDED ABSTRACT

Journal of Medicinal and Organic Chemistry

Thermo-raman studies and electrical properties of the sr1.15na1.7nb4w1-xmoxo15 ceramics

H. Es-soufi[a] L. Bih[a,b] H. Bih[c] A. Alimoussa[d], D. Mezzane[d]

[(a)] Equipe de Physico-Chimie de la MatièreCondensée, PCMC, Faculté des Sciences de Meknes. UniversitéMoulay Ismail, Morocco
[(a)] Equipe de Physico-Chimie de la MatièreCondensée, PCMC, Faculté des Sciences de Meknès. UniversitéMoulay Ismail, Morocco
[(b)] Départementmatériauxetprocédés, ENSAM Meknès, UniversitéMoulay Ismail, Meknès, Morocco
[(c)] Département de Chimie, Faculté polydisciplinaire de Taza, Morocco
[(d)] Laboratoire de la matière condensée et nanostructure–LMCN, Faculté des Sciences et Techniques Guéliz-Marrakech. Morocco

Abstract:

The $Sr_{1.15}Na_{1.7}Nb_4W_{1-x}Mo_xO_{15}$ ($0 \leq x \leq 1$) ceramics, labeled SNNbWM-x, were elaborated by the solid state route. Their structures were studied by X-ray diffraction and Raman spectroscopy and their electrical properties were investigated by impedance spectroscopy. X-Ray patterns of the ceramics reveal that the substitution of tungsten by molybdenum induces a full solid solution and the compounds crystallized in single-phase tetragonal tungsten bronze (TTB) with space group P4bm. Raman spectra of the SNNbWM-x compounds highlighted the vibration modes of the different cations involved in the TTB structure and showed a small peak's displacement according to the Mo/W ratio. The Raman peak position temperature dependence studies had allowed to identify the presence of a phase transition around the temperature Te = 270°C in each compound. The investigation of the electrical properties of the SNNbWM-x samples in the frequency range 20 Hz–10^6Hz at various temperatures from room temperature to 550°C showed that theses ceramics exhibited a phase transition around 270°C in agreement with the thermo-Raman studies.

Introduction:

Es-soufi H. has completed his PhD at the age of 33 years from: Moulay Ismail University, Morocco. He is the director and professor of High private School of Civil Engineering and new Technologies, Morocco. He has over 08 publications that have been cited over 08 times, and his/her publication H-index is 4 and has been serving as an reviewer board member of reputed Journals.

Raman spectroscopy has been employed in combination with rheology previously to elucidate structure and composition in a few systems. Archer et al. used polarized Raman spectra to determine the orientation of polymer melts in combination with optical stress measurements.7 Chemical crosslinking during epoxy curing was observed using a fiber optic Raman probe system in combination with a commercial rotational rheometer.8 Although fiber optic probes are flexible for incorporation with various instrumentation, background scattering in optical fibers and loss of measurement sensitivity limit the range of experiments that can be performed.9 More recent measurements have combined Raman spectroscopy with dynamic light scattering-based microrheological measurements to characterize gelation processes.10 Despite the benefit of combined Raman spectroscopy and rheological information, these prior systems lack the means to characterize the microstructure evolution of the sample or to control the location of the Raman beam with respect to the microstructure. Optical microscopy provides a direct measure of structure within many samples of interest and has been used successfully in the past in combination with rheology.1,3,11 Polarized optical measurements are especially useful in cases where the material exhibits birefringence as in polymer crystallization.12 The benefit of simultaneous measurements is clear: many soft materials are sensitive to temperature and flow history, so simultaneous measurements minimize experimental variation. Kinetic experiments of polymer crystallization, chemical crosslinking, or other chemical reactions are critically sensitive to processing conditions, and the final structure and properties can vary significantly depending on processing history.13,14 Simultaneous measurements reduce the total experiment time, which is especially useful in long-time studies of soft matter and when smaller sample volumes are necessary.

Discussion and Conclusion:

In many industries, including food processing pharmaceuticals, and biomedicine, the demand for multidimensional assessment of the sample composition has increased dramatically. Hyperspectral Raman imaging enables a rapid, routinely practicable, non-destructive food quality and safety evaluation and has turned into a novel clinical diagnostic tool in biomedical applications. It facilitates the investigation of heterogeneous systems and thereby reveals a wealth of chemical and physical information about the chemical composition, short-range atomic structure, structural strain, crystallite orientation. This information is provided with a spatial resolution down to the micrometer length scale. In earth and materials sciences, Raman imaging has been used, for example, (i) for (mineral) phase identification , (ii) to study internal growth structures of minerals such as zonation, (iii) to investigate the substitution of elements in solid solutions , (iv) to investigate isotope substitution and mineral replacement mechanisms, and (v) to in situ study transport and reaction phenomena during solid-water interaction at elevated temperature . With the development of diamond anvil cells and heating devices, the investigation of mineral transformation reactions and their kinetics at high-temperatures and pressures became also possible. In situ high-temperature Raman spectroscopy has been used to study the temperature dependence of first-order phonon bands, pre-melting effects, the structure of melts, as well as solid-state phase transitions.In the last decades, Raman spectroscopy has become one of the most important analytical tools for a wide range of research areas in all sub-disciplines of physics, chemistry, biology, geosciences, and medicine. Initially, Raman spectroscopy was limited to scientific applications, but a low preparation effort, the ease of implementation, and developments in measurement automation have made Raman spectroscopy also interesting to users other than pure scientists. In particular, Raman spectroscopy is used for quality and process control applications.