Challenges to Characterization of Non-metallic Inclusions in Superelastic Nitinol Fine Wires

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Advancements in material processing, medical device design, and surgical technique have led to the miniaturization of implantable devices. The reduced cross-sections of material however are still expected to carry the same or improved performance. This certainly necessitates a clear understanding of the intimate connection between material processing and performance. Moreover, it is imperative to understand how impurities that result from processing affect the lifetime performance of that material. Research on the microcleanliness or in this case, presence of non-metallic inclusions (NMIs), in fine (< 0.140 mm) Nitinol wires are not frequently found in literature.

Characterization of NMIs in fine wires is not without challenge. Techniques and standards typically used for bulk materials simply do not apply at these small size scales. In this work, NMIs in high oxygen content (standard purity - SP) and low oxygen content (high purity - HP) superelastic Nitinol fine wires were characterized. Wires segments were mounted and polished in the longitudinal direction for metallographic analyses including traditional optical and scanning electron microscopy. Additionally, x-ray microscopy and plasma FIB/SEM serial sectioning were performed to provide information about the 3D distribution of the NMIs within the wire volume.

The nominally equiatomic nickel and titanium wires exhibited NMIs with varied morphology, occurred with and without pores, and as stringers along the wire drawing direction and all were composed of nominally titanium-rich nickel oxides. NMI area and volume percentages will be discussed for each wire type along with a comparison of the techniques.

Characterization of Semiconductor and Photonic Materials and Devices Using Cathodoluminescence Microscopy

Dr. Jonathan Lee of Gatan, Inc.

Cathodoluminescence (CL), the luminescence of a material in response to an electron beam, can be used for valuable supplementary analysis in a broad range of applications, useful in geological, commercial, and academic arenas. CL spectroscopy can reveal, with higher spatial resolution than other luminescence techniques, material bandgaps indicative of material composition, the presence of crystal defects, the presence of stress and/or strain, and more. The recent addition of angularly resolved (AR) CL reveals the angular selectivity of specimen emission. This discussion will review several applications of CL and the types of information which can be gained by this method.