THE USE OF AUGER SPECTROSCOPY FOR IN SITU ELEMENTAL CHARACTERIZATION WITH SUB-MICROMETER SPATIAL RESOLUTION: APPLICATIONS AND OUTLOOK.

M. Bose. Laboratory for Space Sciences and Physics Department, Washington University, St. Louis, MO 63130, USA. E-mail: mbose@physics.wustl.edu.

Introduction: Auger spectroscopy is well established in the field of material science and in the semiconductor industry [1], but its use for geological applications has been limited [2], largely because of sample charging issues. Recently however, the technique has found widespread application in the elemental characterization of presolar grains [3-6] and in the analysis of residues in impact craters from the Stardust mission to comet Wild 2 [7-8], where favorable analysis conditions mitigate most sample charging problems. I will review the development of this technique for the quantitative elemental analysis of sub-micrometer presolar silicate grains and outline future prospects for characterizing the small volumes of residue possibly remaining in impact craters from the Al foils of the Stardust interstellar dust collector [9-10].

Principles of Auger Spectroscopy: This technique has the capability to perform elemental characterizations at a high spatial resolution (~15 nm). Such a high spatial resolution can be achieved because of the small primary electron beam size that is attained, and the small analytical volume from which characteristic Auger electrons are measured.

Other advantages include routine non-destructive measurements, detection of all elements in the periodic table except H and He, and no need for special sample preparation.

Quantitative Silicate Grain Analysis: Elemental sensitivity factors and their associated uncertainties were obtained by measuring pyroxene and olivine silicate grain standards with varying mg#s [11]. These elemental factors have been used to determine the elemental composition of hundreds of presolar silicate grains identified in primitive meteorites [e.g., 3-6]. Characterization of numerous silicate grains has shown that the majority exhibit non-stoichiometric elemental compositions. In addition, new presolar phases namely magnesiowüstite [12] and SiO_2 [e.g., 6] grains could be identified.

Measurement of Residues from ISPE Impact Craters: In addition to cometary samples, the Stardust mission also sampled dust from the contemporary interstellar medium. The Al foils from this collector are being searched to identify impact craters [e.g., 9] that may contain residue corresponding to interstellar dust. Auger spectroscopy can be useful for the analysis of such residue, which is expected to present in only minor amounts. The first such analyses have recently been carried out [13, 14] and results will be discussed at the meeting.

References: [1] Watts J. F. and Wolstenhome J. 2003. *An Intro. to Surf. Anal. by XPS & AES* Chichester: Wiley & Sons. [2] Hochella M. F., Jr. et al. 1986. *Am. Mineral.* 71: 1247-1257. [3] Floss C. and Stadermann F. J. 2009. *GCA* 73: 2415-2440. [4] Vollmer C. et al. 2009 *GCA* 73: 7127-7149. [5] Bose M. et al. 2010 *ApJ* 714: 1624-1636. [6] Nguyen A. et al. 2010. *ApJ* 719: 166-189. [7] Stadermann F. J. et al. 2007. *LPSC XXXVIII*, #1334. [8] Stadermann F. J. and Floss C. 2008. *MAPS* 43: A147. [9] Stroud R. M. et al. 2011 *LPSC XLII*, #1753. [10] Floss C. et al. 2011. *LPSC XLII*, #1576. [11] Stadermann F. J. et al. (2009) *MAPS* 44: 1033-1049. [12] Floss C. et al. (2008) *ApJ* 672: 1266-1271. [13] Stroud R. M. et al. (2011) This Volume. [14] Floss et al. (2011) This volume.