CATHODOLUMINESCENCE PROPERTIES OF THE SEMARKONA CHONDRITE: AN IMPLICATION FOR MINERALOGY OF INTERSTELLAR DUST PARTICLES OF THE STARDUST MISSION. A. Gucsik, D.W.G. Sears, J. Craig, F. Sadeghatpour, W. Graupner, Arkansas Center for Space and Planetary Sciences, University of Arkansas, 202 Old Museum Building, Fayetteville, AR 72701, USA (agucsik@uark.edu)

Introduction: The goal of the Stardust mission was to return both particles from Comet Wild 2 and interplanetary dust particles (IDP's). According to the previous studies, these materials are irregularly shaped with porosity ranging from fluffy to compact. The composition, size and other properties depend on where these dust particles found. It is believed that cometary material has been relatively unaltered since the formation of the solar system (when the comets, themselves formed) and so represents the building blocks of the early solar system and our neighboring local stellar medium. IDP's are known to be similar to material derived from comets and asteroids [1,2] and thus will provide useful comparisons. However, to date the origin of the IDPs is poorly known.

Studies of IDPs provide insight about grain dynamics in the early Solar System and presolar interstellar and circumstellar environments. Processes like grain condensation, chemical and physical evolution, and grain density distribution in the proto-planetary disk can be investigated through studies of IDPs. We here discuss cathodoluminescence images of several sections of the primitive Semarkona chondrite to argue that cathodoluminescence observations have the potential information to reveal important details of the mineralogy and geochemistry Stardust particles that might not be readily obtained by other means.

Experimental Procedures: The CL images were produced using a MAAS Luminescope attached to a standard petrographic microscope. The electron gun was typically operated at 15 KeV and 0.7 mA and the beam focused to a 1 x 2 cm ellipse. The images were recorded using standard color film, typically 400 speed, processed commercially using the C-40 processes. A typical thin section required about 40 images. Photomosaics were assembled from the prints and scanned with large flatbed scanner. The exposure time for each image was adjusted to suit the luminescence intensity of the sample and varied from 15 seconds to 7 minutes. the red, blue and green pixels. Further details on the CL imaging of not only Semarkona chondrite, but also other meteorite types can be found in Akridge *et al.* [3].

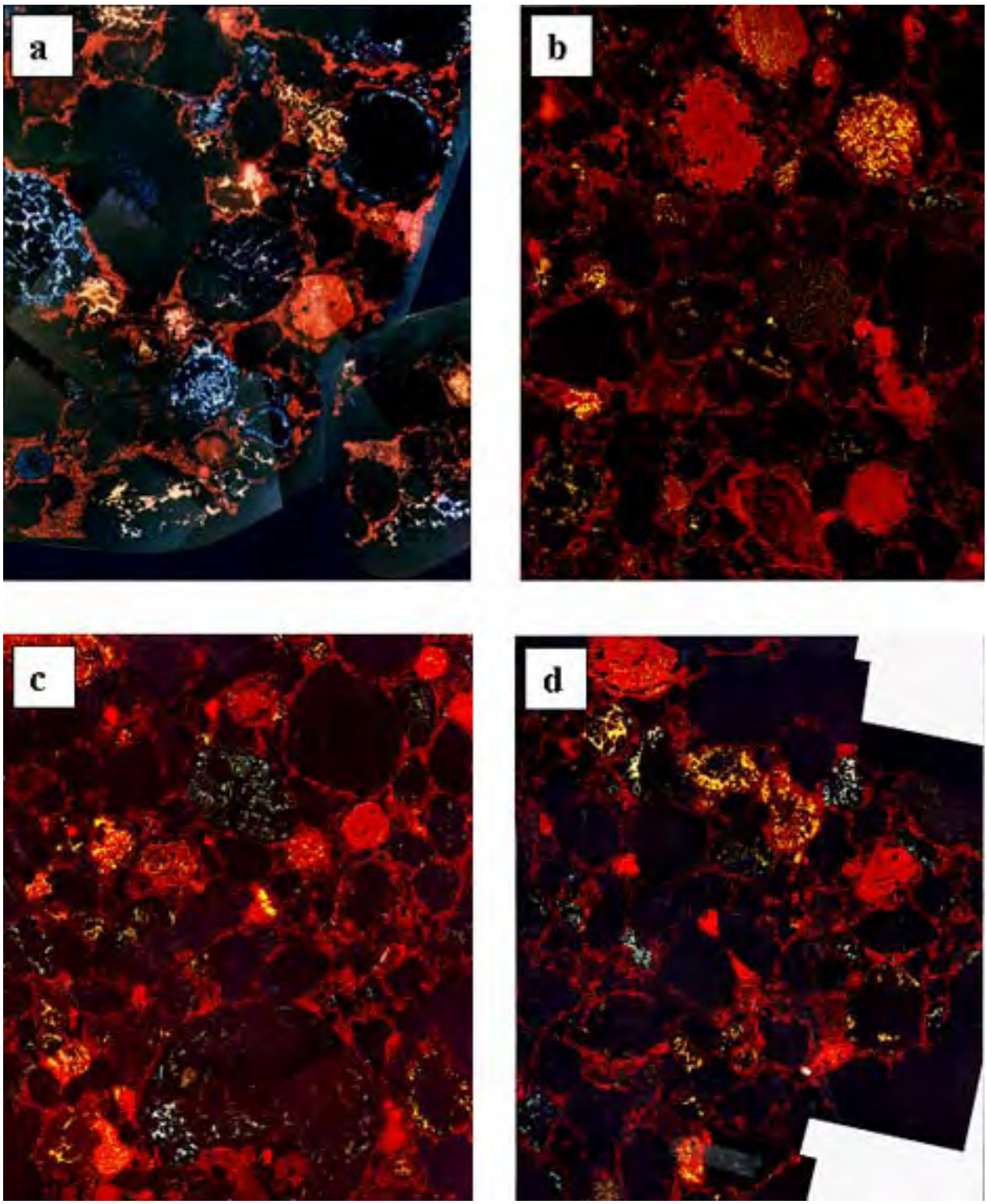
Table 1. Cathodoluminescence properties of chondrule groups in ordinary chondrites and their approximate phase compositions (data from [3])

	CL Color		**Phase Composition**	
Group	***Olivine***	***Meso-stasis***	***Normative Mesostasis***	***Olivine FeO wt%***
A1	red	yellow	An> 50%	<2%
A2	None/ dull red	yellow	An> 50%	2-4%
A3	red	blue	An> 50%	<4%
A4	none/ dull red	blue	An> 50%	>4%
A5	none	blue	An<50%	>4%
B1	none/ dull red	none/ dull blue	Qtz>30%	4-25%
B2	none/ dull red	dull blue	Qtz 30-50%	10-25%
B3	none	purple	Qtz 15-30%	15-20%

Results and Discussion: Cathodoluminescence is especially suited to observing the textural and compositional diversity of chondrules and tracking changes during the metamorphism [4]. Sears *et al.* [5] identified eight classes of chondrules in type 3 ordinary chondrites on the basis of their CL properties and then defined in terms of composition of the olivine grains and mesostasis (Table 1.). Semarkona is unique in its CL properties as it is in many chemical, isotopic and mineralogical properties [3,5]. Large chondrules and other structural components in Semarkona are surrounded by a fine-grained matrix with red CL characteristic of Fe-free olivine. Semarkona contains dominantly B1 (dull red-dull blue), A2 (dull red-yellow), and A1 (red-yellow) [3] (Figs. 1a-d).

On the basis of its composition and density, we doubt that aerogel will present a significant interference for CL and that penetration depths for the beam will be many millimeters. This we will soon be able to test this. Thus we think CL is a means of quickly determining the mineralogy and petrology of large numbers of Stardust particles prior to selection for study by other techniques.

References: [1] Brownlee *et al.* (1989) *LPS XX,* p. 121. [2] Brownlee *et al.* (1999) *LPS XXX,* Abstract #2031. [3] Akridge *et al.* (2004) *JGR, 109,* 1-10. [4] Sears *et al.* (1995) *EPSL, 131,* 27-39. [5] Sears *et al.* (1992) *Nature, 357,* 207-210.



Figures 1a-d. *Cathodoluminescence mosaic images of Semarkona ordinary chondrite (LL3.0). The images are 5 mm across and objects as small as a few micrometers – such as the abundant red forsterite grains in the matrix – can readily be resolved. We suggest that cathodoluminescence would be a means of quickly surveying Stardust particles to get a first order indication of their mineralogy and petrology.*