

AMORPHOUS MATERIALS: PROPERTIES, STRUCTURE, AND DURABILITY†

Preface to the amorphous materials special section

GRANT S. HENDERSON^{1,*} AND DANIEL R. NEUVILLE²

¹Department of Geology, University of Toronto, 22 Russell Street, Toronto M5S 3B1, Canada

²Physique des Minéraux et Magmas CNRS-IPGP 75005 Paris, France

This special issue of *American Mineralogist* focuses on the “Structure and Properties of Silicate Melts and Fluids,” and follows the inaugural meeting “Frontiers in Mineral Sciences 2007” held in Cambridge between June 26–28, 2007 by the four mineralogical societies: the Mineralogical Society of Great Britain and Ireland, the Mineralogical Society of America, the Mineralogical Association of Canada, and the Société Française de Minéralogie et de Cristallographie. Plans for this special issue were initiated during the conference, and we invited all the participants, as well as additional scientists, to contribute papers on aspects of their research related to the theme of the issue. This special issue is itself unique in that it is the first “virtual” special issue of *American Mineralogist*. As such, each manuscript appears in a regular issue of *American Mineralogist* (both print and web) but each paper is in turn linked to the others electronically, so that readers may view and download all the manuscripts belonging to *Amorphous materials: Properties, structure, and durability* as a collection.

Amorphous materials, such as liquids and glasses, lack translational symmetry and, unlike crystalline materials, have no extended periodicity to their structures. The impetus for developing a special issue on amorphous materials stems from renewed interest in the structure of silicate melts within the earth sciences community (cf. Mysen and Richet 2005; Calas et al. 2006). Silicate melts are themselves amorphous liquids that play a fundamental role in magma dynamics and chemistry [cf. Elements 2, no. 5 (2006) on *Glasses and Melts: Linking geochemistry and materials science*, and papers therein].

While in-situ studies of melts would be preferable, and are

becoming increasingly more common, it is easier for experimental reasons to use quenched melts or glasses as analogues. Glasses are considered to have structures that resemble the liquid state but are solid so that experimental data can be extracted more easily (e.g., at room temperature). In addition, an enormous benefit of using glasses is that earth scientists also make significant contributions to the materials science (*sensu stricto*) community particularly with regard to the understanding of the structure and properties of glasses of technological interest. In this special issue, we have attempted to draw together recent work by many of the people working on these fascinating materials, including individuals working on glasses of technological interest and of interest to the condensed matter physics community. These materials are of fundamental importance for Earth and planetary sciences and materials sciences. This virtual special issue draws together original papers of interest to the broader glass and melt community to bring together the latest research on the structure and physical properties of silicate glasses and melts from a physics and chemistry of the Earth perspective. Such information is indispensable for quantitative descriptions of magmatic processes as well as for industrial processes in the glass sciences and metallurgy.

In this and future *American Mineralogist* issues, you will see amorphous materials manuscripts on: spectroscopic methods (NMR, Raman, XAS) for investigating glasses and melts; in-situ studies of molten materials; and theoretical techniques for simulating the structures of different amorphous materials, as well as new topological concepts for understanding the relationships between structure and physical behavior. We hope these manuscripts provide the reader with a broad overview of the exciting cross-disciplinary nature of research on glasses and melts, as well as introduce several concepts or approaches that may not be familiar to people in the Earth sciences.

REFERENCES CITED

- Calas, G., Henderson, G.S., and Stebbins, J.F. (2006) Glasses and melts: Linking geochemistry and materials science. *Elements*, 2, 68 p.
Mysen, B.O. and Richet, P. (2005) *Silicate glasses and melts: Properties and structure*. Elsevier, Amsterdam, 560 p.

* E-mail: henders@geology.utoronto.ca and neuville@ipgp.jussieu.fr

† The Amorphous Materials special section papers were among those presented at the Frontiers in Mineral Sciences meeting, Cambridge, 2007. These articles are published individually and will be available as a group at <http://www.minsocam.org/msa/ammin/toc>.