



DONGHUA XU

Prof. William L. Johnson group, Materials Science Option
Division of Engineering and Applied Science, CALTECH, 138-78
1200 E. California Blvd., Pasadena, CA 91125
Office: 626-395-3571 Fax: 626-795-6132
E-mail: xudh@caltech.edu

EDUCATION

- 2005 PhD, Materials Science, Caltech (graduation expected: Jun. 2005) (advisor: William L Johnson)
- 2002 MS, Materials Science, Caltech (advisor: William L Johnson)
- 1998 BS, Materials Science, Jilin University, P. R. China

AWARDS AND HONORS

1. 1998-2000 Jilin Univ. fellowship for postgraduates, awarded by Jilin University (JLU)
2. 1998 privilege of entering graduate program exempted from admission exams, awarded by JLU
3. 1998 Honor of 'Outstanding Graduation From Jilin Univ.', awarded by JLU
4. 1997 Prize for 'Ten Best Students of Jilin Univ.', awarded by JLU
5. 1997 Baogang Prize for outstanding Chinese students, awarded by BaoSteel Co. (China's largest steel manufacturer)
6. 1994-1998 Jilin Univ. scholarship for undergraduates, and title of 'excellent students of Jilin Univ.', awarded by JLU
7. 1994 Prize for outstanding admissions, first class, awarded by JLU.

PATENT APPLICATIONS

1. *Ni-base bulk refractory glasses based on Ni-Cu-Ti-Zr-Al system*, D.H. Xu and W.L. Johnson (in review by US Patent Office, filed in Dec. 2003; licensed by Liquidmetal Technologies Inc., royalty payment received)
2. *Bulk refractory metallic glasses based on Ni-Nb-Sn system*, H. Choi-Yim, D.H. Xu and W. L. Johnson (in review by US Patent Office, filed in Jul. 2003; licensed by Liquidmetal Technologies Inc., royalty payment received)

RESEARCH EXPERIENCE (PhD Project Summary)

My PhD research work at CALTECH was mainly focused on the synthesis and characterization of novel ordinary-metal-based bulk amorphous alloys (also known as bulk metallic glasses—BMG's). During this research, I worked on a large variety of binary or multi-component metal alloys. I gained first-hand experience with most of the commonly-used elemental materials, including simple metals (such as Al, Sn, Be, Mg, Ca), early transition metals (such as Ti, Zr, Hf, Y, La, V, Nb, Ta, Cr, Mo, W), late transition metals (such as Fe, Co, Ni, Cu, Pd, Ag, Zn) as well as metalloids (such as B, C, Si, Ge, P). I acquired many experimental techniques in materials synthesis, processing and characterization (see next page for detailed Experimental Skills). I successfully developed, independently or together with others, two Ni-based and several Cu-based BMG alloy systems, some of which have exhibited exceptionally high strength up to ~3.8 GPa, high micro-hardness up to ~12.8 GPa, or exceptionally large casting thickness up to 10 mm. These results have been and are continuing to be published in highly-recognized peer reviewed journals including Physical Review Letters. Two patents have been applied for some of my new BMG's. Besides the synthesis and characterization of these new alloys, my work has also made a major contribution to the understanding of BMG formation. Until my work binary alloys were widely considered excluded from the family of BMG's due to their chemical simplicity. My results show that the glass forming abilities of certain Cu-Zr and Cu-Hf binary alloys can be high enough to form 2 mm thick BMG samples. Not only have these binary BMG's challenged the previous concept about BMG formation, but they also provide a wonderful opportunity for theorists to better simulate and model BMG's since these alloys possess both the simplicity of binary alloys and the good glass-forming abilities of multi-component BMG's.

CURRENT RESEARCH INTERESTS

1. Synthesis/fabrication, processing, structure and properties of advanced engineering materials, including amorphous/nanocrystalline alloys, light-weight metals/alloys, intermetallics, superalloys, metal composites, ceramics, etc.
2. Physics, chemistry and metallurgy related to the above materials.

PUBLICATIONS

1. D.H. Xu, W.L. Johnson, 'A geometric model for the critical-value problem of nucleation phenomena containing the size effect of nucleating agent' (accepted for publication in Physical Review B, 2005).
2. G. Duan, D.H. Xu, W.L. Johnson, Q. Zhang, G.Y. Zhang, T. Cagin, and W.A. Goddard, 'Molecular dynamics study of the binary $Cu_{46}Zr_{54}$ metallic glass motivated by experiments: Glass formation and atomic-level structure' (accepted for publication in Physical Review B, 2005).
3. G. Duan, D.H. Xu, W.L. Johnson, 'High copper content bulk glass formation in bimetallic Cu-Hf system', Metallurgical and Materials Transactions A-Physical Metallurgy and Materials Science **36A**, 455 (2005).
4. D.H. Xu, G. Duan, W.L. Johnson, 'Unusual glass-forming ability of bulk amorphous alloys based on ordinary metal copper', Physical Review Letters **92**, 245504 (2004).
5. D.H. Xu, G. Duan, W.L. Johnson, C. Garland, 'Formation and properties of new Ni-based amorphous alloys with critical casting thickness up to 5mm', Acta Materialia **52**, 3493 (2004).
6. D.H. Xu, B. Lohwongwatana, G. Duan, W.L. Johnson, C. Garland, 'Bulk metallic glass formation in binary Cu-rich alloy series - $Cu_{100-x}Zr_x$ ($x=34,36,38.2,40$ at.%) and mechanical properties of bulk $Cu_{64}Zr_{36}$ glass', Acta Materialia **52**, 2621 (2004).
7. H Choi-Yim, D.H. Xu, W.L. Johnson, 'Ni-based bulk metallic glass formation in the Ni-Nb-Sn and Ni-Nb-Sn-X ($X = B, Fe, Cu$) alloy systems', Applied Physics Letters **82**, 1030 (2003).

EXPERIMENTAL SKILLS

materials synthesis (ultrasonic cleaning, induction/arc/resistance melting, metal mold casting, water quenching, vacuum, inert gas sealing, etc.), materials processing (heat treatment under vacuum/inert gas, cold/hot/superplastic deformation, infiltration, condensation, grinding, polishing, etc.), and materials characterization (X-ray Diffraction, Transmission Electron Microscopy, Scanning Electron Microscopy, Energy Dispersive X-ray Spectroscopy, Differential Scanning Calorimetry, Differential Thermal Analysis, Micro-hardness testing, ultrasonic wave speed measurement of elastic moduli, tensile/compression testing, etc.).

PROJECT PARTICIPATED

DARPA (Defense Advanced Research Projects Agency) - SAM (Structural Amorphous Metals)

PROFESSIONAL MEMBERSHIP

American Chemical Society

LANGUAGES

English (proficient, both oral communication and writing)
Chinese (native)

SERVICE ACTIVITIES

1. 2001 Vice President of CaltechC (association of Chinese students and scholars at Caltech)
2. 1998-2000 President of the Graduates' Association of the Dept. of Mater. Sci., JLU
3. 1995-1996 Head of the Study Section of the Students' Assoc. of the Dept. of Mater. Sci., JLU
4. 1994-1998 study monitor of the class, Dept. of Mater. Sci., Jilin Univ.