Nanostructured Interfaces and Surfaces
Centre of Excellence

Università di Torino

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CURRICULUM VITAE

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Marcello BARICCO was born in Torino (October 4th, 1958). He obtained the first degree in Chemistry (Laurea in Chimica) in 1982, was qualified for the profession of chemist (abilitazione alla professione di chimico) in 1983 and he obtained the PhD in Chemistry (Dottorato di Ricerca in Scienze Chimiche) in 1987. He worked as researcher at the Istituto Elettrotecnico Nazionale Galileo Ferraris of Torino from 1986 to 1990. He moved to the Department of Chemistry (Dipartimento di Chimica IFM) of the University of Torino in 1990 as University Researcher in Physical Chemistry. He reached the position of Associate Professor in Metallurgy in 1998 at the Faculty of Science (Facoltà di Scienze MM.FF.NN.) at the University of Torino. From 2004 he is full professor in Metallurgy at the University of Torino.
He is now at the Department of Chemistry of the University of Torino, where he's carrying out teaching and research activities. He was supervisor of about 40 degree thesis in Chemistry, Industrial Chemistry, Materials Science, Strategic Science and of 8 Ph.D. thesis in Chemical Science and Materials Science and Technology. He is President of the Teaching Council in Industrial Chemistry (Presidente del Consiglio del Corso di Studi in Chimica Industriale) at the University of Torino. He is a member of the National Research Group in Metallurgy (Consorzio Interuniversitario di Ricerca per la Metallurgia - CIRM), of the National Institute for Condensed Matter (Istituto Nazionale di Fisica della Materia -CNR/INFM/CNISM), of Italian Materials Science and Technology Group (Consorzio Interuniversitario per la Scienza e

Tecnologia dei Materiali - INSTM) and of Excellence Center on "Nanostructured Interfaces and surfaces" of the University of Torino.
He has been responsible for the University of Torino in several national and international research projects with research institutions and industrial partners (PRIN-MIUR, UE, CRUI, Regione Piemonte). He participated as scientific leader to research projects in the frame of the IV, V and VI Framework programs of the European Community (BRITE, RTN, MC-RTN). A Research Training Network focused on the synthesis of Bulk Metallic Glasses (BMG) and their physical properties was successfully concluded in 2002 (HPRN-C7-200-00033). A MCRTN project on Ductilisation of Bulk Metallic Glasses (BMGs) by Length-scale Control in BMGs Composites and Applications (MRTN-CT-2003-504692) is now running. A MCRTN project on Complex Solid State Reactions for Energy Efficient Hydrogen Storage (MRTN-CT-2006-035366) is also running.
The research activity is mainly based on Physical Metallurgy and it has been carried out at the Laboratory of Metallurgy of the Chemistry Department of the University of Torino. The scientific contributions have been presented in about 180 papers, published in international and national journals, and in several invited talk in international and national meetings. The main research topics are related to metastable phases in metallic systems and may be classified as follow:
a) Microstructure and kinetics of phase transformations in metallic systems;
b) Thermodynamic properties an phase diagrams in metallic systems;
c) Magnetic, mechanical and chemical properties of amorphous alloys and intermetallic compounds.

The preparation of metastable metallic phases has been obtained by rapid solidification techniques (melt-spinning e planar-flow casting). In particular, amorphous and nanocrystalline alloys have been prepared in Fe-based and Al-based systems. More recently, Zr-based and Mg-based bulk amorphous alloys have been prepared by copper moulding technique.

With the aim to identify suitable composition for glass-formation, thermodynamic properties of solid and liquid phases have been studied, either theoretically and experimentally. The glass-forming range has been estimated for various systems by means of phase diagrams calculations. Staring from the assessment of thermodynamic properties of equilibrium phases, the calculation has been extended to metastable and amorphous phases. Experimental thermochemical data have been obtained by calorimetry. Commercially available programs (CALPHAD, Thermocalc) have been used for the calculations of the free energy of all phases as a function of composition and temperature. From the assessment, the driving force for nucleation of crystalline phases form the liquid and amorphous phases have been calculated as a function of composition and temperature. So, the glass-forming range has been estimated for Al-Ce, Al-Nd e Fe-B. The effect of thermal treatments on the amorphous phase (structural relaxation, crystallisation) has been studied by means of several experimental techniques: Differential Scanning Calorimetry, X-ray diffraction, electron (TEM e SEM) and optical microscopy. The kinetic analysis of crystallisation in amorphous alloys have been carried out on the basis of nucleation and growth models. Considering the effect of various parameters, TTT curves for solidification and crystallisation have been estimated. The formation of nanocrystalline phases has been studied in several Fe-based and Al-based amorphous alloys, which leads to improved magnetic and mechanical properties, respectively. The crystallisation processes have been modelled by means of the moving

boundary model (DICRA). The study of crystallisation has been extended to glass systems for fibre optics in collaboration with CSELT (now AGILENT).

In collaboration with TEKSID S.p.a. (Torino), solidification and phase transformations have been studied in binary Fe-C alloys and in cast irons of industrial interest. In collaboration with the Istituto Elettrotecnico Nazionale Galileo Ferraris (Torino), magnetic properties of various metallic systems have been investigated. Giant magnetorestance have been studied in granular systems in the frame of the PRA/ELTMAG project (INFM). Soft and hard magnetic properties have been investigated in amorphous and nanocrystalline alloys with various compositions. In collaboration with the Materials Science Department of the Polytechnic of Torino, electrocatalytic properties and corrosion resistance have been investigated in amorphous alloys and intermetallic compounds. More recently, hydrogen absorption and desorption is studied in nanocrystalline Mg-based alloys for hydrogen storage.

Project in last 5 years:
V framework program of EC: RTN project "Bulk Metallic Glasses", Contract HPRN-CT-2000-0003
VI framework program of EC: MCRTN project "Ductilisation of Bulk Metallic Glasses (BMGs) by Length-scale Control in BMG Compositesand Applications" Contract MRTN-CT-2003-504692
VI framework program of EC: MCRTN project "Complex Solid State Reactions for Energy Efficient Hydrogen Storage (COSY)" Contract MRTN-CT-2006-035366
VI framework program of EC: Network of Excellence "Complex Metallic Alloys" (CMA) "Materials for hydrogen storage"
Italian Government (MIUR): PRIN2002 (2002038584_004) "Functional nanocrystalline alloys: synthesis and characterisation"
Italian Government (MIUR): PRIN2003 (2003038751_003) "Thermodynamic and functional properties of non-equilibrium alloys and compounds"
Italian Government (MIUR): PRIN 2005 (2005097983_002) "Amorphous and nanocrystalline Fe-based alloys"
Regione Piemonte: 2004 "Materials for hydrogen storage"
Private companies: 2004 Leg.Or "Rapid solidification techniques for preparation of alloys for the gold industry"
Private companies: 2003 ILTE "Materials and processes study for off-set printing"
Private companies: 2004 Consulta dell'Unione Industriale di Torino "Metallurgical analyisis of the gate of the Royal Palace of Turin"