

# **METHODS FOR THE PRODUCTION OF BULK IRON-BASED AMORPHOUS AND NANOCRYSTALLINE MATERIALS AND THEIR PROPERTIES**

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Bulk amorphous materials comprise a relatively new group of materials that were first designed in 1989. These materials are unique due to properties they exhibit. Their properties are much better than those of their crystalline counterparts with the same chemical compositions, and these differences are directly related to their structure. In addition, the properties of these materials can be improved as a result of the designed processes - leading to their controlled nanocrystallisation. As a result of nanocrystallisation in the amorphous matrix, fine crystalline grains with dimensions of less than 100 nm, in one direction, are formed. Iron-based amorphous and nanocrystalline materials are very promising. Given suitable chemical compositions, these materials can exhibit soft-magnetic properties. The range of applications for this class of materials is very wide - especially in the electrotechnical, electronics and energy industries. However, the production of these materials is very difficult; this is why scientists from all over the world are constantly looking for new production methods, as well as new chemical compositions and nanocrystallisation methods. In the Department of Physics, at Czestochowa University of Technology in Poland, several techniques have been developed for the production of rapidly-cooled materials, as well as a one-step process for the production of nanocrystalline materials. In addition, over 100 new bulk amorphous alloys with good vitrification properties have been produced. The Author's achievements have been patented, and some additional patent applications are pending approval.