

TECHNOLOGY OF FABRICATION IN RELATION TO MICROSTRUCTURE OF Ni-Ti SHAPE MEMORY ALLOYS

This article deals with preparation of Ni-Ti shape memory alloys in plasma furnace and vacuum induction furnace. Then swagging and drawing was carried out to produce wires, which will be used for measurement of transformation temperatures.

Рассмотрен процесс производства никель-титановых сплавов с эффектом памяти в плазменной печи и в вакуумной индукционной печи. Было произведено провисание и волочение с целью получения проволоки, которая будет использована для измерения температур фазового превращения.

Intermetallic compound containing approx. 50 at. % Ni and 50 at. % Ti is considered as standard shape memory alloy. The basic requirement to metallurgy of these advanced materials is strict adherence to chemical composition of the alloy, which is the main condition for obtaining of the alloy with the required transformation temperatures. At use plasma melting, material is placed into copper water-cooled mold. This is drifted by bolt under plasma burner. Argon is used as plasma forming gas. For the melting as such it is necessary to use the cleanest available argon due to high affinity of titanium to oxygen. Plasma temperature achieves at this method of melting 6500 K. Chemical homogeneity can be achieved at vacuum induction melting. Material of crucible has at this method the principal influence on quality of ingot. Crucibles made of Al_2O_3 and MgO cannot be used due to oxygen content. Oxygen contained in graphite crucible can be neglected, it is, however, necessary to take into account absorption of carbon. Ni-Ti based alloys are usually melted at the temperature of approx. 1500 °C. For obtaining of wire it is best to use technology of swagging in combination with subsequent drawing. Aim of hot forming consists in change of casting structure and achievement of satisfactory grain size that is suitable for subsequent cold drawing. This article deals with preparation of Ni-Ti shape memory alloys in plasma fur-

nace and vacuum induction furnace. Then was carried out swagging and drawing to produce wires, which will be used for measurement of transformation temperatures.

Development of science and technology in all branches of industry means interconnection of the whole series of new findings with implementation of advanced methods at production of materials with high service properties or special properties. NiTi based intermetallic shape memory alloys undoubtedly belong to such materials. They find application in numerous industrial and other branches, such as e.g. medicine, robotics and communication technology.

Alloys with shape memory effect have generally several variants of shape memory behaviour. Generally speaking these are pseudoelasticity, shape memory phenomenon (irreversible), reversible shape memory phenomenon and universal shape memory.

At use of plasma melting material is placed into copper water-cooled mold. This is drifted by bolt under plasma burner. Argon is used as plasma forming gas. For the melting as such it is necessary to use the cleanest available argon due to high affinity of titanium to oxygen. Plasma temperature achieves at this method of melting 6500 K. It is possible to use this method also for refining of initial titanium from titanium sponge.

Chemical homogeneity can be achieved at vacuum induction melting by selection of

suitable magnitude of alternating current, which influences induction and thus also mixing of the melt. Material of crucible has at this method the principal influence on quality of ingot. Crucibles made of Al_2O_3 and MgO cannot be used due to oxygen content. Oxygen contained in graphite crucible can be neglected, it is, however, necessary to take into account absorption of carbon.