Relationship between Combustion-Wave Propagation Behavior, Porous Microstructure and Mechanical Properties of TiNi Porous Body Produced by Self-Propagating High Temperature Synthesis

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TiNi alloys are recently being expected as one of the most promising biomaterials because it has outstanding properties such as shape memory, superelasticity and high corrosion resistance. Even though TiNi is applied to medical fields mainly in bulk form, porous TiNi bodies can be suitably used for not only effective bone in growth but also higher fixation and stability due to a larger contact area. In the present work, we report how the heating schedule of the self-propagating high temperature synthesis(SHS) of TiNi bodies influences their combustion behavior and pore structure. In addition, the resulting changes in mechanical properties are discussed.

Elemental Ti and Ni powders were mixed to have a composition with an atomic ratio of 1:1 at a rotation speed of 90rpm for 12h. Powder mixture was filled into a quartz tube of 40mm in diameter and compacted by tapping. Subsequently, the compacted powder was heated in a tube furnace at a heating rate of 20℃/min under protective Ar atmosphere. A R-type thermocouple was inserted into the compact to measure the combustion temperature and wave propagation. the structure and size of the pores were determined with an image analyzer. To prevent the strut structure of the porous bodies from collapsing and to enable the investigation of their mechanical properties, the bodies were prepared by an electric discharge machining.