Feedstock set-up of the biocomposite material for alloplastic bone grafts manufacturing

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In case of the small-sized bone reconstruction, specific grafts may have complex geometries. The powder metallurgy technology is one of the most recommended to elaborate small bone grafts made of hydroxyapatite (HAP) and titanium based composites [1].

The technological novelty of our research is the use of the medium-pressure injection moulding (MEDPIMOLD) to shape HAP-based biocomposite grafts. The raw material, named feedstock, represents the mixture between the wax-based binder system and the biocomposite powders. The binder system consists of the following components (% mass): paraffin wax (20-40), carnauba wax (5-15), bees wax (5-15), ethylene vinyl acetate-EVA (40-50) and stearic acid (2-7). The biocomposite powders mixture is made of (70-80) % HAP (30-50 μm), (15-25) % TiH_2 (~ 100 μm), citric acid (1-3) % and $CaCO_3$ and NH_4HCO_3 each of (1-2) %.

The feedstocks were studied and the ratio between the binder system and the biocomposite powders were: 1:1, 0.9:1.1 and 1.1:0.9.

The aim of this study is to investigate the influence of the feedstocks viscosity on the green parts properties: thermo-physical and micro/macro-structural properties by thermal analysis (TA), Fourier transform infrared spectroscopy (FTIR), optical microscopy (OM), and mechanical tests.

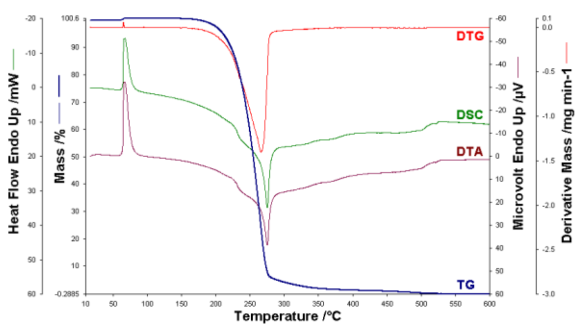

Fig. 1

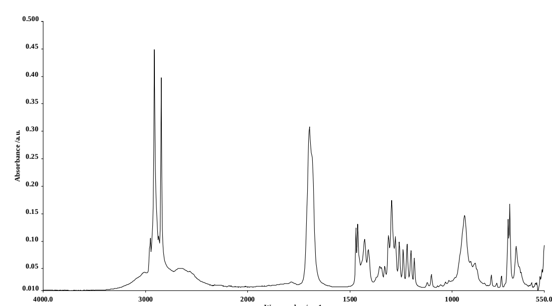

Fig. 2

In Fig. 1 are given the thermoanalytical curves of oxidative decomposition of one of the components of the feedstock to manufacturing biocomposite material for alloplastic bone grafts: stearic acid. As the other binders, stearic acid is decomposed totally at rather small temperatures.

Fig. 2 shows the FTIR spectra of the same stearic acid.

[1] A. Arifin, A.B. Sulong, N. Muhamad, J. Syarif, M.I. Ramli. Mat. Design, 55 (2014) 165