CHARACTERIZATION OF NEWLY DEVELOPED FEEDSTOCK IN METAL INJECTION MOULDING APPLICATION USING TITANIUM MIX WITH PALM STEARIN BINDER SYSTEM

RESEARCH MANAGEMENT INSTITUTE (RMI)
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM SELANGOR
MALAYSIA

BY:

NOR HAFIEZ BIN MOHAMAD NOR
MUHAMMAD HUSSAIN BIN ISMAIL
PROF. DR. NORHAMIDI BIN MUHAMAD

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PROJECT TEAM MEMBERS

NOR HAFIEZ BIN MOHAMAD NOR
Project Leader

....

MUHAMMAD HUSSAIN BIN ISMAIL
Project Member

....

PROF. DR. NORHAMIDI BIN MUHAMAD
Project Member

....

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ABSTRACT

Metal Injection Molding (MIM) process has some features such as shape complexity, low production cost and tight tolerance. The MIM process consists of four steps such as mixing, injection molding, debinding and sintering. These steps are dependent upon the types of binder used. Successful production of parts by MIM is closely related to the binder system utilized. The role of the binder is to serve as a temporary or transient phase to impart flowability and moldability to the powder mixture. This will enable the shaping of the feedstock to the desired shape during injection molding.To have a good understanding of the MIM process and successful in manufacturing, characterisation of the material feedstock is essential. This paper presents the characterization of MIM feedstock consisting titanium alloy (Ti-6Al-4V) powder mix with binder 60wt% of palm stearin and 40wt% polyethylene. The characterisation of Ti-6Al-4V alloy powder, binders and feedstock includes scanning electron micrograph (SEM), thermo gravimetric analysis (TGA), differential scanning calorimeter (DCS) and rheological test were established. Rheological results exhibited pseudoplastic or shear thinning flow behaviour, where its viscosity decreased with increasing shear rate. The feedstock viscosity also decreased with increasing temperature and was found to be suitable for moulding. The feedstock is loaded with Ti-6Al-4V at volume ranging 63, 65, 67, and 69 percentages. The binder composition consists of 60% palm stearin and 40% polyethylene based on weight fraction. The feedstock that is suitable for injection molding has possessed the highest value in shear sensitivity (n-1), lowest activation energy (E) and highest moldability index, (α_{STV}). Optimization of the rheological data shows that feedstock of 63vol % has the best rheological properties when it flow at 144.68°C.