idity. Increasing the binder content and the nozzle temperature resulted to a decrease in the maximum injection pressure and improvement in the fluidity of the powder. Using the same PE content, increasing the temperature resulted to an increase in tensile strength of the injected product. However, the strain at break was decreased. Moreover, at PE content below 50%, the strength and strain decreased considerably.

APP-13: Development of High Performance Ti Products by Micro Metal Injection Molding
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Micro metal injection molding (μ-MIM) is hoped to be one of manu-
factoring process for minute parts in various engineering fields. In order to
improve the quality of μ-MIM products, several techniques have been
developed in the process. For example, it is important to make homoge-
neous pellets because the size of products is quite smaller than a grain
of single pellets. In the previous study, evaluation method of pellets was
established and optimum mixing conditions were investigated. Moreover,
injection molding process is also important to produce micro size pro-
ducts. One of solution methods is to use the micro injection molding ma-
cine. On the other hand, the properties of final products are influenced
by the debinding and sintering processes. By controlling the debinding
and sintering conditions, the quality and performance of the products
would be improved. In this study, high quality and high performance
micro metal injection molded parts were produced and evaluated.

APP-14: Effects of Powder Size and Initial Ar-
angement on Cold Compaction
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In the past, the most common assumption in every explicit modelling
of individual powders for compaction is that powders have only one single
size which are arranged uniformly. However, all powders used in practice
have a distribution of particle size and random initial arrangement. In
this work, a systematic theoretical study of the effects of initial powder
arrangement and distribution of size has been investigated using numeri-
cal analysis tool. Various types of elements have been considered first.
Considering the accuracy and the effort required, the two-dimensional
plane strain element has been employed for the rest of the investigation.
The initial arrangement of powder and the distribution of powder size
were considered separately. The results show that the initial arrangement
has significant influence on the macroscopic behaviour while the powder
size has little influence. Both factors have noticeable influence on the
microscopic behaviour.

APP-15: Effect of Lubrication on the Improve-
ment of Uniformity in Uniaxial Powder Com-
paction
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Density distribution in powder compact caused by frictional force at die
wall has been estimated. The pressure transmission ratio \(\lambda\) was defined
for the estimation of the magnitude of frictional force occurrence on die
wall. The density gradient \(\alpha\) was also defined for the estimation of density
distribution. The iron and pre-alloyed stainless powder were tested, and
the performance of zinc stearate and paraffin wax applied as internal
lubricant or die wall lubricant has been investigated in various conditions.
The die wall lubrication becomes effective way to increase \(\lambda\) in comparison
with the internal lubrication. Admixed lubricant prevents the occurrence of
density distribution and uniform green compact is obtained in the
critical amount of lubricant. Paraffin wax shows higher performance as a
die wall lubricant compared with zinc stearate, and remarkable increase
of lubrication effect is observed in the combination between zinc stearate
as internal lubricant and paraffin wax as wall lubricant.

TUESDAY AFTERNOON, June 21

16:00 p.m. - 17:30 p.m. Room D

IMP-11: Determination of Interlaminar Shear Strength of a Unidirectional Carbon/Epox-
y Laminated Composite under Impact Loading
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In recent years, composite materials are increasingly replacing conven-
tional metallic materials in aerospace, civil, marine and automotive indus-
tries, because of superior high specific stiffness and strength. Some ap-
lications of composite materials involve dynamically loaded components
and structures. Hence, there is a need to fully understand the dynamic
behavior of composite materials for the analysis and design of composite