ABSTRACT
This study aimed to determine optimum sintering parameters of IN718 superalloy powder parts which are shaped by the Powder Injection Moulding (PIM) method. At initial stage IN718 powder was mixed with a multi-component binder system. The resulting mixture was granulated and injected as standard tensile bar form. After moulding IN718 specimens were subjected to debinding process which consists of solvent debinding and thermal debinding steps. To determination of sintering temperatures, debinded samples were subjected to Differential Scanning Calorimetry (DSC) and dilatometer analyses, and then they were sintered at various temperatures under high level vacuum. After sintering, density measurements and optical microscope examinations were performed. Sintered density values have increased depending on increasing of sintering temperature. The highest density value was determined for the sample which sintered at 1290°C.

Keywords: Powder Injection Moulding, superalloy, IN718, sintering, microstructure

INTRODUCTION
Superalloys are a class of high temperature resistant alloys which can be Ni, Fe or Co based. Superalloys exhibit an excellent combination of strength and surface stability both at cryogenic and high temperatures [1]. Nickel based superalloys have a complex composition and good high temperature properties and they have most widely application area in all classes of superalloys [2]. Nickel-based superalloys are the most commonly used materials for gas turbines, aircraft engine components, critical parts for jet engines, rocket engines, nuclear components, tool materials and metals for the hot working dies [3]. Today, the world’s most widely used superalloy is inconel 718 alloy [4]. However it is very difficult to produce complex shaped parts from inconel 718 due to its high Ni content [5]. In conventional production methods such as casting or forging undesirable segregation or the need for machining make the production more costly [6, 7]. There is also difficulty in forming complex shaped parts from Ni based superalloys make it inevitable producing these type of materials by powder metallurgy methods.

Although the PIM is a one of the powder metallurgy process, it provides denser and thus superior mechanical properties than conventional powder metallurgy methods. It is also enables more complex parts which are difficult producing with conventional production techniques such as casting, forging, machining and die compaction. PIM also provides high dimensional accuracy in complex parts [8]. Recently, powder injection moulding (PIM) of superalloys for a variety of gas turbine engine parts has attracted attention [9-14].

In this study IN718 parts were shaped by powder injection moulding method. To determine optimum sintering parameters, the shaped samples subjected sintering processes which were performed at different temperatures for various periods of time. Density measurements and microstructural examinations were conducted for sintered samples.

EXPERIMENTAL PROCEDURES
In experimental studies, gas atomized prealloyed IN718 powder was used. Composition of this powder is given in Table 1. In Fig. 1.a scanning electron microscope (SEM) image of IN718 powder is given. To determine particle size distribution of IN718 powder Mastersizer analysis was performed. The curve of this analysis is seen in Fig. 1.b. From Fig. 1 it is observed that particle shape of IN718 powder