International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

COPY RIGHT

ELSEVIER
SSRN

IJIEMR Transactions, online available on 23rd Sept 2021. Link
:http://www.ijiemr.org/downloads.php?vol=Volume-10&issue=ISSUE-09

DOI: 10.48047/IJIEMR/V10/I09/46

Title **INVESTIGATIOIN OF PROCESS PARAMETERS EFFECT ON MICROSTRUCTURE AND MECHANICAL PROPERTIES OF ALUMINIUM ALLOY 6061THROUGH SEMI-SOLID SQUEEZE CASTING**

Volume 10, Issue 09, Pages: 409-413

Paper Authors
Gandham Veera Venkata Satya Sairam, V V Ramakrishna

USE THIS BARCODE TO ACCESS YOUR ONLINE PAPER

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

INVESTIGATIOIN OF PROCESS PARAMETERS EFFECT ON MICROSTRUCTURE AND MECHANICAL PROPERTIES OF ALUMINIUM ALLOY 6061THROUGH SEMI-SOLID SQUEEZE CASTING

Gandham Veera Venkata Satya Sairam[1], V V Ramakrishna[2]
[1]M.Tech Student, Pydah College of Engineering Patavala, Kakinada.
[2]Associate Professor, Pydah College of Engineering Patavala, Kakinada.

Abstract:
Semi solid squeeze casting is a process of combination of conventional casting and forging. Adoption of this process has been delayed as several complications rose during manufacturing. To increase its usage, the SSM community has to provide awareness about the process and its advantages so that one can get confidence to adopt this technique.This aim of this project is to manufacture plate by semi-solid squeeze casting process and various mechanical properties like tensile, flexural strength, compression, hardness, impact resistance, micro structure will be evaluated. This project also involves in identifying the elevating properties over casting and forging process.
An aluminum compound of 6061 has been utilized to make an example where various properties are distinguished over projecting and manufacturing measure. The main motivation to carry out this analysis is to reduce the inconvenience incurred in the production process in companies. Semi-sharp projection can be used for high-end applications such as aluminum composites, combination of main and aircraft components, pressure components, guards, engine mounts, saddles variable air assembly, engine mount and oil siphon channel cover.
A combination of a high pouring temperature, a high pressure, and a high die temperature influence the mechanical properties and the microstructure of the material. Non-dendrite particles are primarily alpha in nature, since they distribute uniformly throughout the matrix. The size of the alpha particles decreases as the applied squeezing pressure increases, which results in an improvement in mechanical property. The shape and size of the alpha particles also increase as the pouring and die temperatures are raised. Pouring temperature should be 575 °C, die temperature 250 °C, and squeezing pressure 100 mPa for best micro structure and mechanical properties.
Key words: aluminum alloy6061, semi-solid squeeze casting, microstructure, tensile strength, compression strength, flexural strength, hardness, and impact strength,

Introduction

An extremely low level of porosity can be obtained with semi-solid castings that have extremely high mechanical properties. The process has not yet achieved the wide-spread

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

commercial application envisioned in its early days in spite of its many advantages. Semi-solid cast aluminum components have been successfully used in many commercial products.

The aim of this paper, consequently, is to look at commercial packages for semi-stable castings. However, in preference to searching backwards on the successes and disasters of diverse semisolid castings, this paper will rather appearance ahead with the goal of growing techniques essential for the broader commercialization of the semi-stable casting process. The overall performance and manufacturing strategies of semi-stable castings may be reviewed, with the aim of figuring out business niches in which semi-stable castings can offer clean advantages over different casting process. This paper, consequently will offer a evaluation of mechanical houses among semi-stable castings and different casting processes, investigate the functions of most suitable semi-stable casting processes, compare the traits of additives that might gain for manufacturing through semi-stable casting, evaluate production charges of diverse casting processes, and describe the forms of high-satisfactory structures that casters want to have in location to make those forms of castings.

Aluminium alloy 6061:

AA 6061 is a high-electricity alloy that gives desirable stress, corrosion resistance, cracking resistance. Known as a mainstay withinside the aerospace enterprise because it become introduced, Aluminum 6061 brings slight durability in addition to an first-rate electricity-to-weight ratio. It is likewise critical to be aware that at sub-0 temperatures Aluminum 6061 will increase in electricity.

Composition:

The composition of aluminium alloy 6061 is mentionedin the table

Element	Content (%)
Aluminium / Aluminum, Al	98
Magnesium, Mg	1
Silicon, Si	0.6
Copper, Cu	0.29
Chromium, Cr	0.21

Table-1: Composition ofaluminium alloy 6061

Mechanical properties:

Properties	Value
Tensile strength	310 MPa
Hardness	95
Flexural strength	298 MPa
Compressive strength	240 MPa
Impact strength	280 MPa

Table-2: Mechanical properties of AA6061 casting

Experimental procedure:

For semi solid squeezed technique of aluminium alloy 6061 (AA6061) the cast iron die is manufactured for the rectangular specimen of dimensions 150*100*10mm (Length*breath* thickness). The die is heated up to 270^0C and motel metal AA6061 is poured in the die cavity at a temperature of 575^0C and leave the die undisturbed to solidification.

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

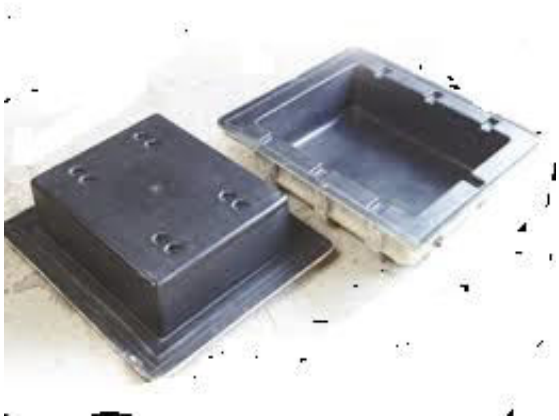


Fig-1: Die for SSSC

When the temperature of the semi solid AA6061 reaches to 460^0C. After reaching the temperature 460^0C close the mould with the male die and place a dead weight over it which is equal to 100MPa. Leave the setup undisturbed for some time. Remove the specimen to be tested from the cavity the cavity.

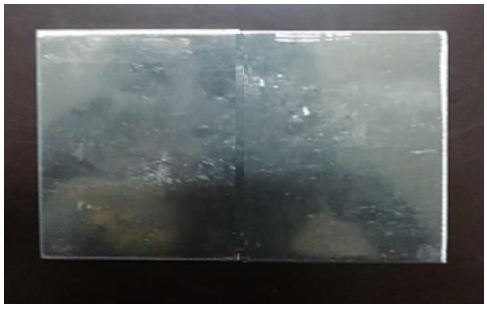


Fig-2: specimen after removing from the mould cavity.

Specimen is cut into the required dimensions for testing according to ASTM standards. To evaluate the mechanical and microscopic properties. The specimens required are tensile, compression, impact, hardness, flexural strength and micro structure.

Fig-3: Specimens of tensile, impact, hardness, micro structure and flexural strength

Results and discussion:

The samples are tested in the respective machines and results are evaluated for tensile test, compression strength, impact strength, flexural strength and hardness. Properties of semi solid squeezed casting and casting is compared. The table shows the detailed test results

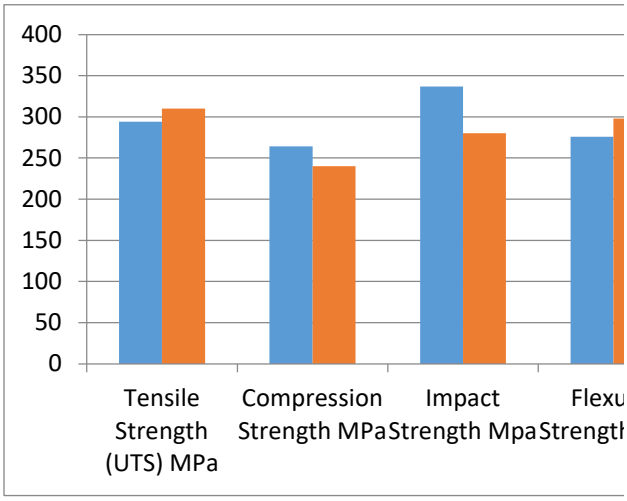
Properties	SSSC	Casting
Tensile Strength (UTS)	294 MPa	310 MPa
Compression Strength	264 MPa	240 MPa
Impact Strength	337 MPa	280 MPa
Flexural Strength	276 MPa	298 MPa
Hardness	102	95

Table-3: mechanical properties comparison of SSSC over normal casting

In the results the tensile strength of SSSC is 294 MPa but when compared to the conventional casting (310MPa)is low due change in the micro structure (reduction in the grain size) and the compression strength is increased 14 MPa(i.e., SSSC 264MPa and conventional casting 240MPa). The impact

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

strength varied with a reasonable change for SSSC 337 MPa where asconventional casting posses 280 MPa. Flexural strength is reduced when compared to conventional casting(298MPa for conventional casting and 276 MPa for SSSC).



Graph-1:the graph represents the variation in the mechanical properties of SSSC and conventional casting.

Micro structure of the SSSC has fine grain size when compared with the normal casting. The microscopic images are taken with 100 magnification ration. Microscopic images for grain size are take inside the material and on the surface. That shows a clear info that grain size in the images are similar. It means there is no change in the grain size throughout the material. The material formed is homogenous throughout the material.

Fig-4: Microscopic view of the SSSC AA6061 inside the material with 100 magnification ratio.

Fig-5: Microscopic view of the SSSC AA6061 inside the material with 100 magnification ratio.

Conclusion:

- Comparison for SSSC and conventional casting is done
- Tensile strength is more in conventional casting (310 MPa) when compared with the SSSC (294 MPa)
- Compression strength is increased 14 MPa (i.e., SSSC 264MPa and casting 240MPa

- The impact strength varied with a reasonable change for SSSC 337 MPa where as conventional casting posses 280 MPa.
- Flexural strength is reduced when compared to conventional casting (298MPa for conventional casting and 276 MPa for SSSC).
- There are no remarkable changes in the micro structure throughout the material.

References:

[1] Z. Fan, Int. Mater. Rev. 47 (2) (2002) 1–39.

[2] S.J. Luo, W.C. Keung, Y.L. Kang, Trans. Nonferrous Met. Soc. China 20 (2010) 1805–1814.

[3] V.L. Dao, S.D. Zhao, W.J. Lin, Spec. Cast. Nonferrous Alloys 31 (8) (2011) 687–690.

[4] S. Kleiner, O. Beffort, A. Wahlen, et al., J. Light Met. 2 (2002) 277–280.

[5] M.R. Ghomashchi, A. Vikhrov, J. Mater. Process. Technol. 101 (2000) 1–9.

[6] T.M. Yue, G.A. Chadwick, J. Mater. Process. Technol. 58 (1996) 302–307.

[7] A. Maleki, A. Shafyei, B. Niroumand, J. Mater. Process. Technol. 209 (2009)3790–3797.

[8] A. Maleki, B. Niroumand, A. Shafyei, Mater. Sci. Eng. A 428 (2006) 135–140.

[9] M. Mosoumi, H. Hu, Mater. Sci. Eng. A 528 (2011) 3589–3593.

[10] S.M. Skolianos, G. Kiourtsidis, T. Xatzifotiou, Mater. Sci. Eng. A 231 (1997)17–24.

[11] J.H. Lee, H.S. Kim, C.W. Won, et al., Mater. Sci. Eng. A 338 (2002) 182–190.

[12] S.Y. Chang, J.C. Choi, Met. Mater. 4 (2) (1998) 165–171.

[13] Y.B. Zhai, C.M. Liu, Z.T. Han, et al., Rare Met. 27 (2) (2008) 329–334.

[14] Q. Chen, B.G. Yuan, G.Z. Zhao, et al., Mater. Sci. Eng. A 537 (2012) 25–38.

[15] W.M. Mao, Q. Zheng, D.P. Zhu, Trans. Nonferrous Met. Soc. China 20 (2010)1769–1773.

By.
Student name : GANDHAM VEERA VENKATA SATYA SAIRAM(1)
Email: sairamgandham3@gmail.com
Designation:(M.Tech)
Mobile number:9618389831.
College address: Pydah College of Engineering Patavala, Kakinada.
Name: VV. Ramakrishna(2)
Designation: Associate professor & HOD
Mobile no : 9618270225
Email id: vvrk98@gmail.com
College adress: PydahCollege of Engineering Patavala, Kakinada.