**Friction Stir Welding of Al-Mg Alloys as a Replacement of Mg and Si consumables in GMAW and GTAW welding**

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**EXPERIMENTAL WORK**

**Gas Metal Arc Welding (GMAW)** is a welding process, which uses an electric arc maintained between a continuously fed filler consumable wire and the parts to be welded.

**Gas Tungsten Arc Welding (GTAW)**, also known as tungsten inert gas (TIG) welding is a process that produces an electric arc maintained between a nonconsumable tungsten alloy electrode and the parts to be welded.

The process uses inert or active shielding from an externally supplied gas to protect the molten weld pool.

**Gas Metal Arc Welding**

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**Gas Tungsten Arc Welding**

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**RESULTS**

**Mechanical properties of EN-AW 5052-00**

<table>
<thead>
<tr>
<th>Proof strength $R_{p0.2}$ (MPa)</th>
<th>Ultimate tensile strength $R_{m}(MPa)$</th>
<th>Elongation $A_{s}$(%)</th>
<th>Vickers hardness number $H_{V}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>124±10</td>
<td>193±3</td>
<td>22±1</td>
<td>60±1</td>
</tr>
</tbody>
</table>

**Chemical composition of EN-AW 5052-0 aluminium alloy (in weight %)**

- Cu: 0.09
- Mn: 0.09
- Mg: 2.78
- Si: 0.24
- Fe: 0.38
- Zn: 0.046
- Ti: 0.015
- Al: bal.

**Chemical composition of X38CrMoV5-1 tool steel (in weight %)**

- C: 0.37
- Si: 1.01
- Mn: 0.38
- P: 0.017
- S: 0.005
- Cr: 4.85
- Mo: 1.23
- V: 0.32
- Fe: bal.

**CONCLUSIONS**

According to the presented results, some conclusions can be drawn:

- Higher mechanical properties were obtained with lower welding speeds and with the tool with reservoir to pin ratio of 0.5.
- The highest ultimate tensile strength was 3% higher, while the yield strength was 25% higher compared to the base material, considerably higher than the values obtainable with GMAW and GTAW processes.
- The same tool resulted in more uniform weld hardness values, due to a wider central part of the stir zone, but also in a higher roughness parameters.
- The flexibility of the FSW process and welding speeds are considerably lower than in arc welding.