1. Motivation
- Recycling of Mg scrap leads always to pick up undesired elements such as Fe, Cu, Ni and Co.
- Such impurities reduce the corrosion resistance of Mg-alloys even at low concentrations (Fig. 1).
- Except for Fe there is currently no procedure to remove these impurities from Mg-alloys.
- Some elements e.g. Zr, Ca and Ti have been seen to bind intermetallic with impurities like Cu.

2. Material and Equipments
- Commercial magnesium alloys used for investigations:

| Mg-alloy | Al(%) | Zn(%) | Mn(%) | Si(%) | Fe(%) | Cu(%) | Ni(%) | Others (%)
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AZ31</td>
<td>2.6-3.5</td>
<td>0.7-1.4</td>
<td>0.2-1.0</td>
<td>max. 0.30</td>
<td>max. 0.01</td>
<td>max. 0.05</td>
<td>max. 0.001</td>
<td>Max. 0.05</td>
</tr>
<tr>
<td>AM50</td>
<td>4.5-5.3</td>
<td>0.20</td>
<td>0.28-0.50</td>
<td>max. 0.05</td>
<td>max. 0.004</td>
<td>max. 0.008</td>
<td>max. 0.001</td>
<td>0.01</td>
</tr>
</tbody>
</table>

- Synthesis of “mother alloys” from above alloys and 1% Cu
- Synthesis of magnesium “master alloys” with precipitation elements (Zr, Ca)
- Ti-Sponge

3. Methodology of Experiments
- The conversion temperature of each mother alloy has been determined through DTA.
- Each of the “mother alloys” were melted separately with the master alloys Mg-Ca and Mg-Zr, held at ca. 10°C higher than conversion temperature and then cooled slowly in the furnace (Fig. 2).
- The AZ31+1wt%Cu was melted while pieces of Ti sponge were suspended in the melt via stirring (Fig. 2).
- The samples were studied through ICP chemical method as well as through metallography and SEM/EDAX.

4. Chemical Analysis
- Composition (wt%) of Mg-alloys treated with Ca respectively Zr for Cu precipitation:

<table>
<thead>
<tr>
<th>AZ31-Cu-Ca</th>
<th>Al(%)</th>
<th>Zn(%)</th>
<th>Mn(%)</th>
<th>Si(%)</th>
<th>Fe(%)</th>
<th>Cu(%)</th>
<th>Mg(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.02</td>
<td>0.889</td>
<td>0.391</td>
<td>0.0240</td>
<td>0.0110</td>
<td>0.896</td>
<td>94.8</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AZ31-Cu-Zr</th>
<th>Al(%)</th>
<th>Zn(%)</th>
<th>Mn(%)</th>
<th>Si(%)</th>
<th>Fe(%)</th>
<th>Cu(%)</th>
<th>Mg(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.31</td>
<td>0.797</td>
<td>0.336</td>
<td>0.0120</td>
<td>&lt;0.00120</td>
<td>0.714</td>
<td>95.3</td>
<td></td>
</tr>
</tbody>
</table>

- Final Cu content of AZ31 after 2h stirring with Ti-sponge: 0.85 wt%

5. Metallography and SEM Results
- Aluminium existed in the alloy has formed compositions with Ti (probably intermetallic phases- see Fig. 3-5) and therefore copper was not attracted by Ti.
- Probably copper can be removed through natural segregation if the melt is solidified very slowly based on the findings, where it was found precipitated at the bottom of the crucible (see Fig. 6).