**INTRODUCTION**

- Nitinol is a Nickel-Titanium-Alloy (55% Ni, 45% Ti)
- As a memory alloy it belongs to the smart materials
  - First developed in 1958
  - Biocompatible
  - Flexible
  - Noncorrosive
  - Twinned martensite structure for T<310°C
    - Martensite structure gets detwinned
    - Transformation to austenite structure caused by heating
  - Many applications
    - Medicine (flexible instruments or implants)
    - Aerospace (thermal couplings)

**NITINOL AS SPRING**

- Made from nitinol wire
  - Different diameters
  - Endless number of turns possible
    - High actuator stresses and strokes
  - Springs can pull or push, depending on working principle
  - Resulting force depends on diameter, number of turns and start temperature

**TRANSFORMATION TO MECHANICAL ENERGY**

- Direct transformation from heat to mechanical energy
  - Decoupled from the reaction room by using steam
  - Four springs parallel connected

**PROCESS FLOWSHEET**

**CONSTRUCTION**

- Storage tank: Hydrogen peroxide
  - Steady flow
- Liquid separator tank: Avoids catalytic solution in the storage tank
- Pressure equalization between storage tank and reactor
- Chain-blocks: Two rolls to quadruplicate the distance
- Condensate tank: Collects condensation water
  - Connected to the pressure relieve valve

**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight [kg]</td>
<td>14.9</td>
</tr>
<tr>
<td>Size h x w x d [mm]</td>
<td>660 x 680 x 440</td>
</tr>
<tr>
<td>Operating pressure [bar]</td>
<td>1 – 1.5</td>
</tr>
<tr>
<td>Operating temperature [°C]</td>
<td>100</td>
</tr>
</tbody>
</table>

**PROTECTING THE RELEASE OF H₂O₂**

- Hydrogen peroxide can be drawn into the copper pipes
- Platinum is an excellent catalyst for the decomposition of H₂O₂
- Filter packed with platinum pellets eliminate remaining traces of H₂O₂
  - Only H₂O and O₂ are released
  - No H₂O₂ remains in the system

**PRESSURE AND TEMPERATURE**

- Pressure relieve valve limits the system pressure to 2.5 bar absolute
- Pressure relieve valve is connected to the Condensate tank to prevent splashing
- Reactor, tubes and pipes are isolated

**CHEMICALS**

- While handling the chemicals the following safety equipment has to be worn:
  - Nitrile gloves
  - Lab coat
  - Protective glasses

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**REFERENCES**