

# Fabrication and optimization of different armour materials by PIM

## Activity 1: Armour Materials

WP13-MAT-01-HHFM-01-01/KIT/PS

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# Objective

## Work Programme 2013

HHF tests on samples of WP12 (FZ Jülich and IPP Garching) in progress

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### **Goal 2013: Fabrication and optimization of different W armour materials by PIM**

1. Development of PIM materials with different chemical compositions
2. Production / fabrication of prototype grades via PIM
3. Adaptation of the heat-treatment process (in close cooperation with PLANSEE SE)
4. Characterization of mechanical and physical properties (in close cooperation with OXFORD Materials)
5. HHF testing (in close cooperation with FZ Jülich and IPP Garching) and characterization after testing

# (1) Development of PIM materials with different chemical compositions

## Powder particle size (as-delivered):

- W                    0.7 – 1.7  $\mu\text{m}$
- $\text{La}_2\text{O}_3$             1.5  $\mu\text{m}$
- $\text{Y}_2\text{O}_3$              2.5  $\mu\text{m}$
- TiC                  30 – 50 nm



## Material development:

- W (pure)
- W-2 $\text{La}_2\text{O}_3$  (5.7 vol.-%  $\text{La}_2\text{O}_3$ )
- W-0.5 $\text{Y}_2\text{O}_3$  (2.1 vol.-%  $\text{Y}_2\text{O}_3$ )
- W-1 $\text{Y}_2\text{O}_3$  (4.2 vol.-%  $\text{Y}_2\text{O}_3$ )
- W-2 $\text{Y}_2\text{O}_3$  (8.1 vol.-%  $\text{Y}_2\text{O}_3$ )
- W-1TiC (3.8 vol.-% TiC)
- W-1.5TiC (5.6 vol.-% TiC)
- W-2TiC (7.3 vol.-% TiC)
- W-3TiC (10.6 vol.-% TiC)

## (2) Production / fabrication of prototype grades via PIM

### Material development



Powder



Binder



Mixing /  
Kneading /  
Extrusion



Feedstock



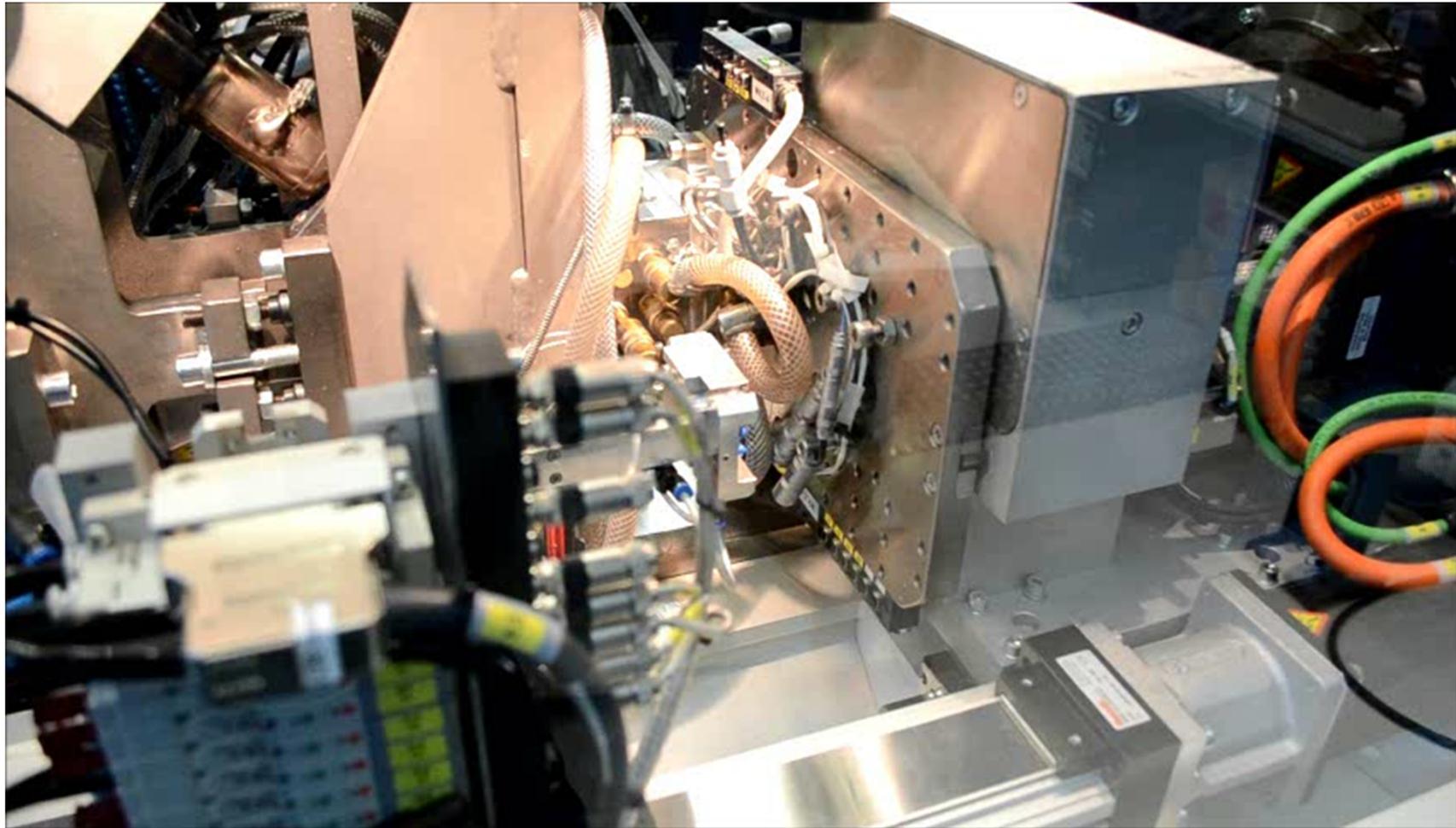
Injection molding



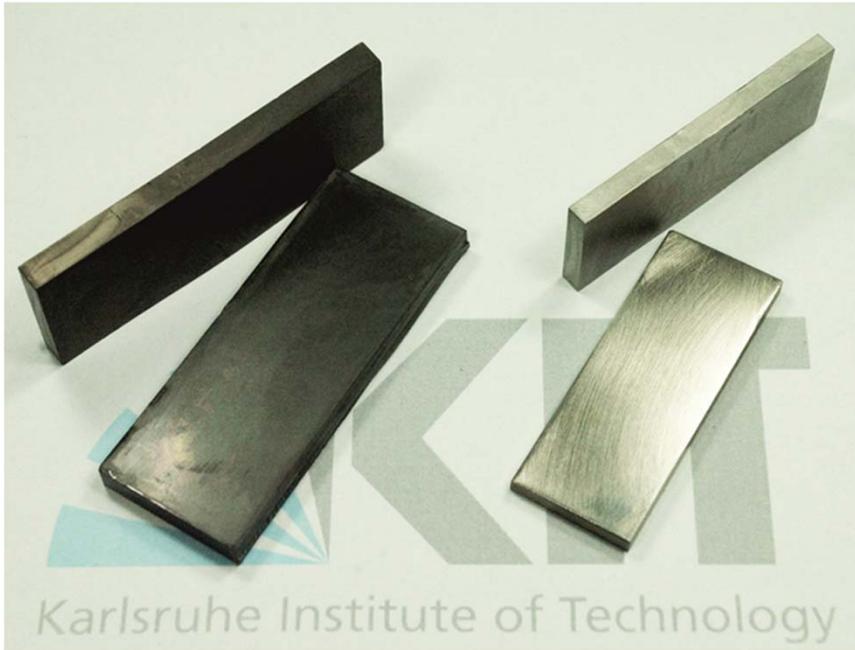
### Producing of green parts



## (2) Production / fabrication of prototype grades via PIM



(3) Adaptation of the heat-treatment process (in close cooperation with PLANSEE SE)



W-PIM plate (length x width x thickness)  
(55 x 22 x 4 mm), weight: 75 g



**Heat-treatment (only Sintering):**

- dry H<sub>2</sub> atmosphere
- 1800°C (2h) + 2400 °C (2h)

W tensile test spec. (length x width x thickness)  
(16 x 1.6 x 1.2 mm), weight: 0.9 g

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**Thank you very much!**

