USE OF X-RAY MICROTOMOGRAPHY TO CHARACTERIZE INTERNAL INTERFACES

A. Lefrancois, P.Rey, P.Le Breton*, T.Vallero**

CEA Gramat
*JUNGHANS T2M
**TDA

Fuze conference 3 – 5 may 2016
Objectives of microtomography studies

Apparatus description
Several applications

Dedicated characterization

Device and 1.4 s container description
Results and discussions
OBJECTIVES OF MICROTOMOGRAPHY STUDIES
X-ray Tomography new model Skyscan 1172:
- CCD 4000 x 2670, rotation min: 0.01°
- Resolution: 1 µm
- Pixel size with magnification max max: 0.8 µm
- Object dimension max Ø 45 mm H 70 mm
- Tension < 100 Kv, current max 250 µA,
- power max 10 W

Former X-ray Tomography model Skyscan 1072:
- CCD 1024 x 1024, rotation min: 0.23°
- resolution: 2 µm,
- pixel size with magnification max : 1.8 µm
- Object dimension max Ø 20 mm H 40 mm
μtomography benefits / flash X-ray

- Metal particles recovery and analysis
- Grain size distribution
- Shape

Soft flash X-ray

A.Lefrançois et al. APS 2011
APPLICATIONS

µtomography benefits / metallographic methods

- Pristine and post-mortem analysis of HE
- 3D defects: debonding, cracks
- Porosity identification
- Faster method

A.Lefrancois et al. ISIEMS 2002  V.Chuzeville et al. IPS 2015  J.Corbel et al. ISL meeting 2016
Applications

Micro- Meso-structural meshing for numerical materials

- Meshing from the material microstructure
  - Reconstruction tools with dedicated segmentation
  - With and without binder
  - Local porosity defects identification

A. Fanget et al. Symposium IUTAM 2013
APPLICATIONS

Traction test inside the µtomograph

- Mechanical and microstructural characterization
  - Direct measurement
  - Local defects identification

A. Fanget et al. Symposium IUTAM 2013

CEA | 3-5 Mai 2016 | PAGE 8
DEDICATED APPLICATION
Objectives

- Characterization after cold thermal cycle
- Development of 1.4s container for safety compliance
  - Contain the frag and blast effects
  - Should not affect the μtomography analysis
Validation of the safety container

- Container design with plastic and conductive filler
- Perform several performance tests
- Post mortem analysis and validation for safe use
Gap analysis

- Geometrical gaps induced by the forming process
Gap analysis

- Interface between inert and energetic material
Gap analysis

- Interface between inert and energetic material
Applications

- Several applications for pristine and post-mortem analysis
- Dedicated for dedicated characterization
- Analysis after cold thermal cycle

Coming soon

- Hot or cold cycle during the analysis to see potential gaps
- Traction/compression inside the \( \mu \)tomograph
- Process characterization, density defects, gaps
- Flyer characterizations, screening test, craters, statistics …