



# L12: Defects database

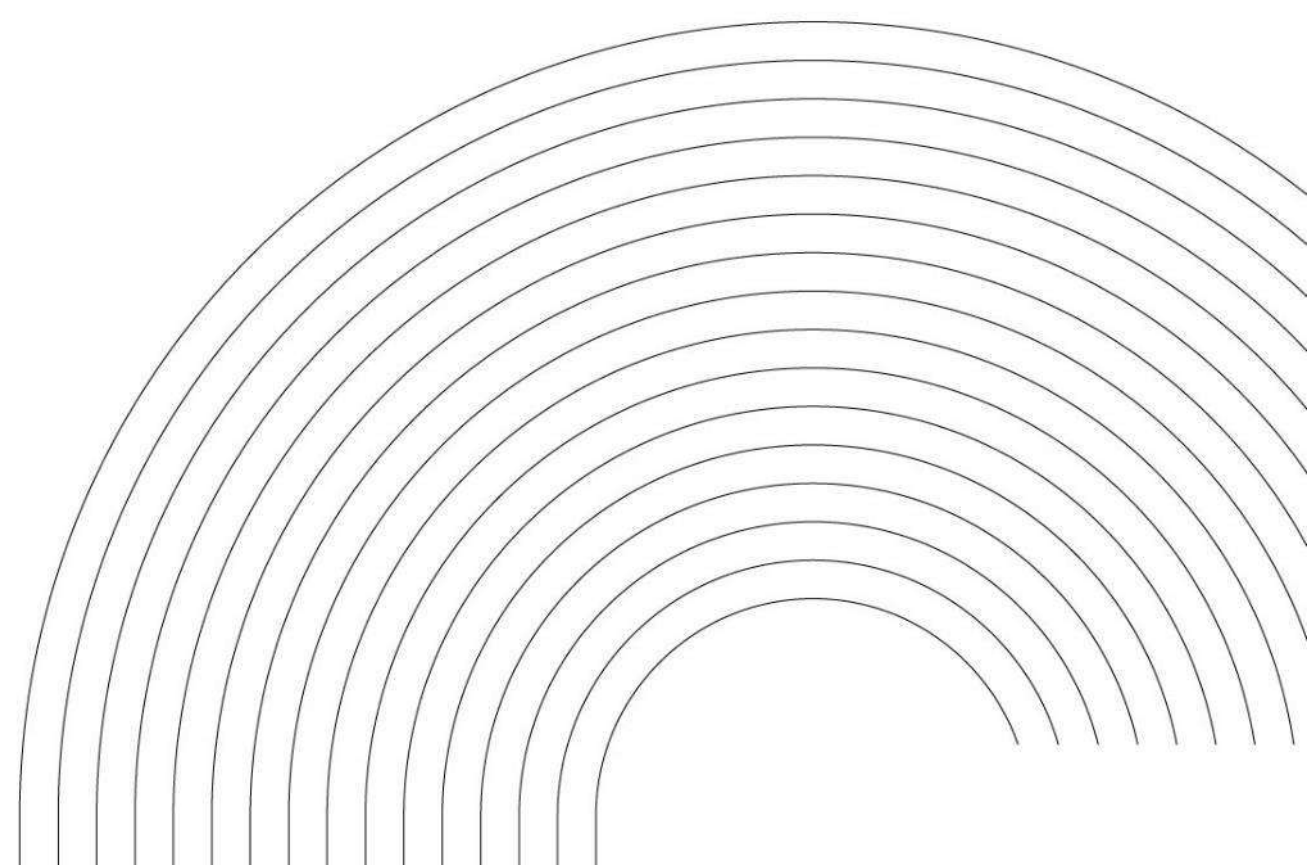
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# Introduction



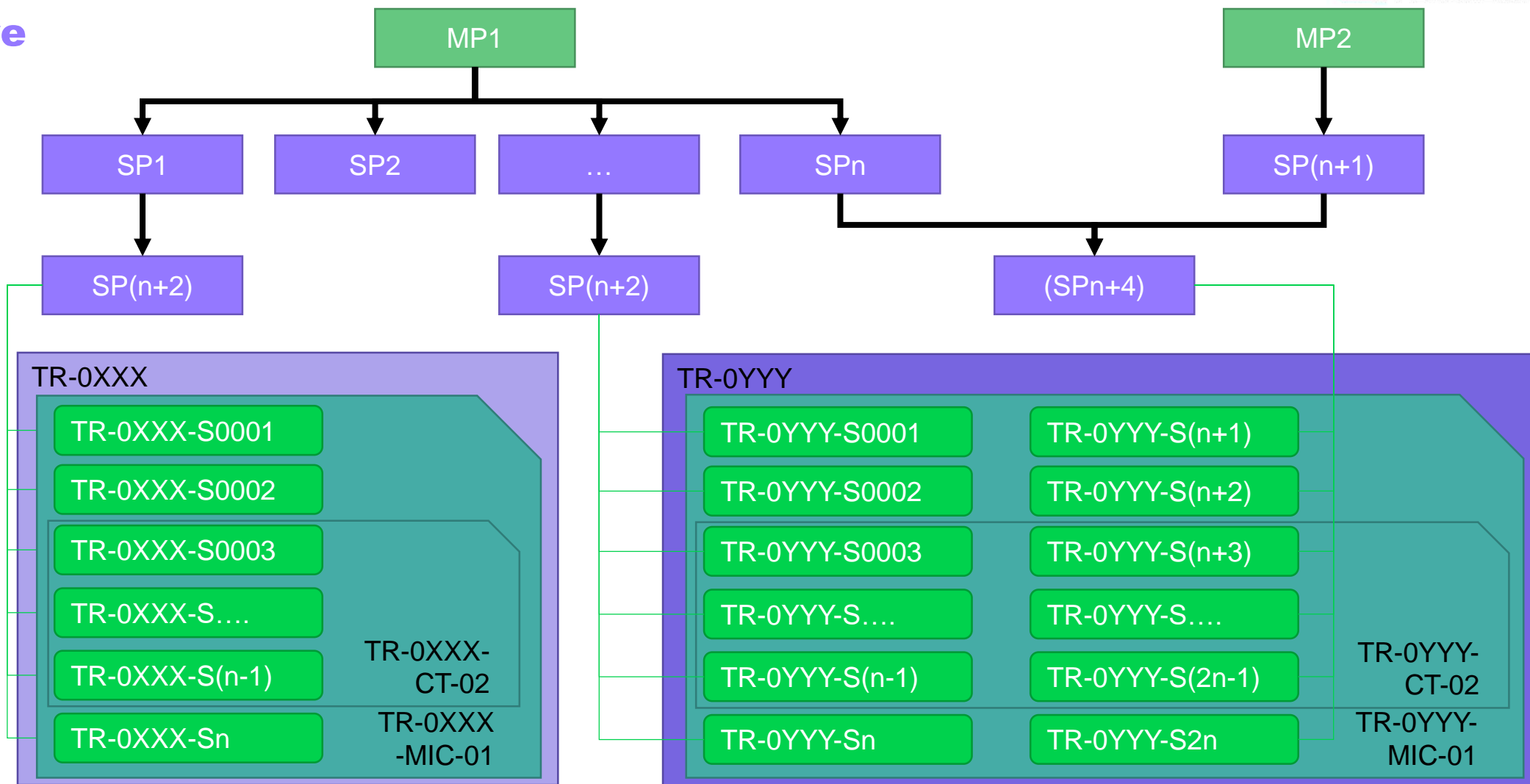
## Objective

- Structuration of the material data base produced in all the project
- List and classify defects detected in the material



# Remind: material data base

## Structure



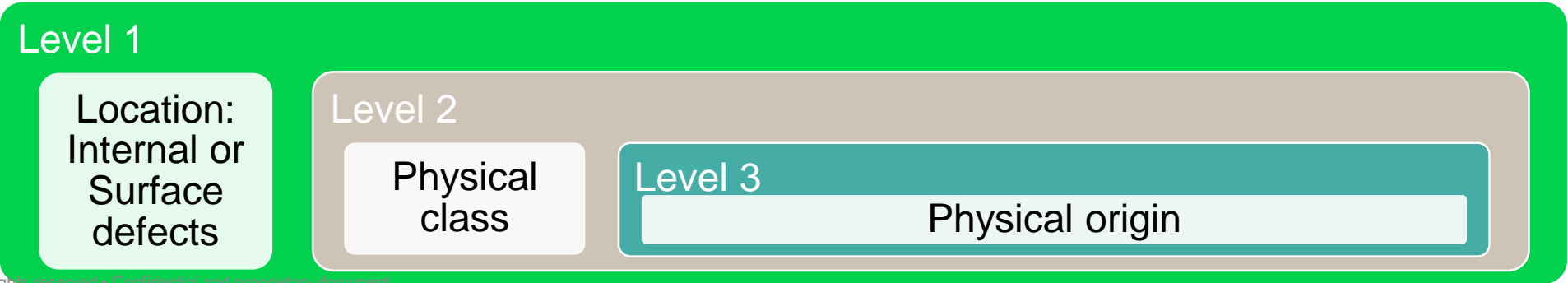
# Defect database

## Structure

- Described in deliverable L19
- Proposed approach: 3 levels classification
- Widely inspired by the work of Bonollo et Fiorese (2013, 2015)

1 <sup>st</sup> Level	2 <sup>nd</sup> Level	3 <sup>rd</sup> Level
A  Internal Defects and Imperfections	A1  Shrinkage defects and imperfections	A1.1 Macro-shrinkage
		A1.2 Interdendritic shrinkage
		A1.3 Layer porosity
	A2  Gas-related defects and imperfections	A2.1 Air entrapment porosity
		A2.2 Hydrogen porosity
		A2.3 Vapor entrapment porosity
		A2.4 Lubricant and/or die release agent entrapment porosity
	A3  Filling-related defects and imperfections	A3.1 Cold joint
		A3.2 Lamination
		A3.3 Cold shot
	A4  Undesired phases	A4.1 Inclusion
		A4.2 Undesired structure
	A5  Thermal contraction defects and imperfections	A5.1 Cold crack
		A5.2 Hot tear, hot crack

Bonollo et al. “Database on Defect - StaCast Project.” Italie: University of Padova - 2013.



# Defect database

## Implementation

- 32 classes of defects proposed
- Grouped in 3 categories
  - A – Internal defects
  - B – Surface defects
  - C – Geometrical defects



➔ Link between defects and samples on going

TEEXMA

Defects

Metal

Additive Manufacturing (EBM/LBM/LMD)

A1.1 - Powder induced pore

A1.2 - Vaporized alloys elements

A1.3 - Inert gas entrapment

A1.4 - Hydrogen pores

A2.1 - Shrinkage defect

A3.1 - Hatching induced LOF

A3.2 - Interlayer LOF

A3.3 - Spatter induced LOF (screening)

A4.1 - Liquation cracking

A4.2 - Solidification cracking

A4.3 - Strain-age cracking (SAC)

A4.4 - Ductility Dipe Cracking (DDC)

A5.1 - Inclusions

A5.2 - Precipitates

A5.3 - Oxides

A5.4 - Microstructural heterogeneity

B1.1 - Balling

B1.2 - Spattering

B1.3 - Swelling

B1.4 - Ejected powder // Denudation

B2.1 - Residual stress induced crack

B3.1 - Powder size induced

B3.2 - Stair stepping induced

B3.4 - Power interruption

B4.1 - Oxidation

B4.2 - Miscelaneous

C1.1 - Deformation (stress induced retraction)

C1.2 - Down skin surfaces collapsing

C1.3 - Process induced

C2.1 - Remaining support

C2.2 - Lack of material

C2.3 - Excess of material

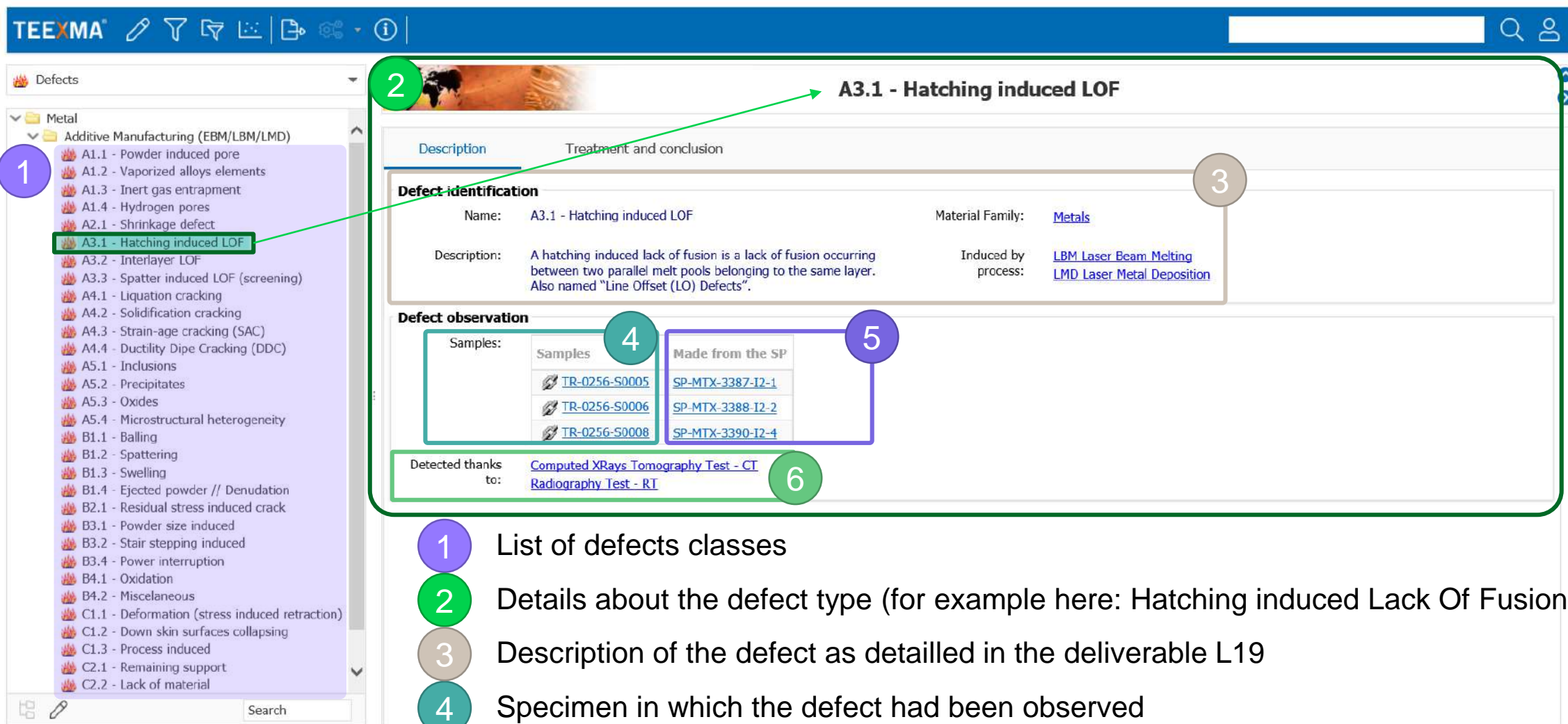
Composites

Defects classes as listed in database



# Defect database

## Implementation – Description of the content



The screenshot shows the TEEXMA Defect database interface. On the left, a sidebar lists defect classes under 'Metal' and 'Additive Manufacturing (EBM/LBM/LMD)'. The main panel displays details for 'A3.1 - Hatching induced LOF'. The interface includes a search bar, a list of defect classes, and a detailed view of a specific defect with its description, observation, and detection methods.

**1** List of defects classes

**2** Details about the defect type (for example here: Hatching induced Lack Of Fusion)

**3** Description of the defect as detailed in the deliverable L19

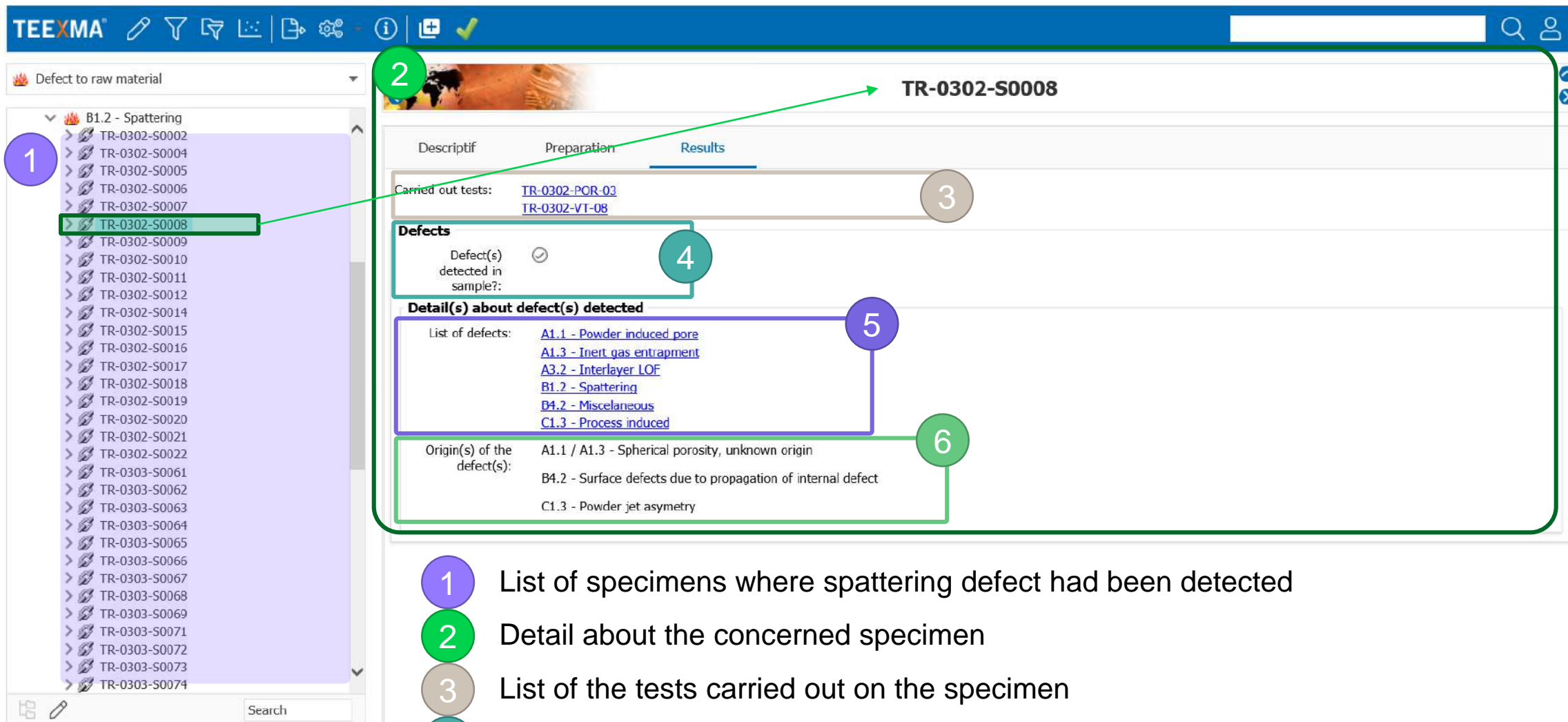
**4** Specimen in which the defect had been observed

**5** Link between the specimen and the semi product

**6** NDT method which allowed the detection of this type of defect

# Defect database

## Implementation – Link to the specimen



The screenshot displays the TEEXMA interface. On the left, a list of specimens under the category 'B1.2 - Spattering' is shown. Specimen 'TR-0302-S0008' is highlighted. On the right, the details for this specimen are shown, including a list of tests carried out, a list of defects detected, and the assumed origin of the defect(s).

Numbered callouts (1-6) indicate key features:

- 1: List of specimens where spattering defect had been detected
- 2: Detail about the concerned specimen
- 3: List of the tests carried out on the specimen
- 4: Detection of defect
- 5: List of the type of defects detected in the specimen
- 6: Assumed origin of the defect(s)



# Conclusions



- High level of traceability
- Storage of the project results guarantee
- Results of the other MMP' project are also referenced in the material database
- Material database fully operating, filling in progress
- Defect database fully operating, filling in progress



- ➔ Modification of the test results management on going
  - ➔ Improvement of the readability
  - ➔ Improvement of the results importation and extraction