

Date: 02/03/2020

investigation report

Report Name: Together Forged PM steels (sample 2)

Report Number: MUE 19231

Customer Supplier: Zapp Precision Metals

Main application:

Material: unknown Dimension: sample 2

inspection lot: Production order:

Melt:

Summary For an investigation forged pattern was filed. each forged documents are studied in this pattern

and Conclusion: such as

Hardness measurements are carried out on the individual layers. For the metallographic investigation of the material was prepared in the micrograph. In the middle of the sample had a broad layer (seam) is composed of a PM steel with numerous carbides in a martensitic matrix, see Figure

9. From the PM layer sequentially light and dark layers (thin layers) are starting to see, see Figures 3 to 8. The first light location in the transition zone very contains many matrix Carbide (Figure 10), which decrease up to the edge. The matrix appears ferritic with precipitates on the grain boundaries, see Figures 12, 13 and 15, which are present independently of the coating layer uniform pronounced. The subsequent dark layer has the appearance of a martensitic structure, see Figure 11, which has with increasing distance to an increasing content PM-position brighter acicular structures probably austenite (Figure 14). To the material, the hardness of the individual layers was measured. This hardness testing could not be performed in compliance with standards,

signatures

Gez .: Dominic Lococciolo

Signed .: Dr. Sedat Güler

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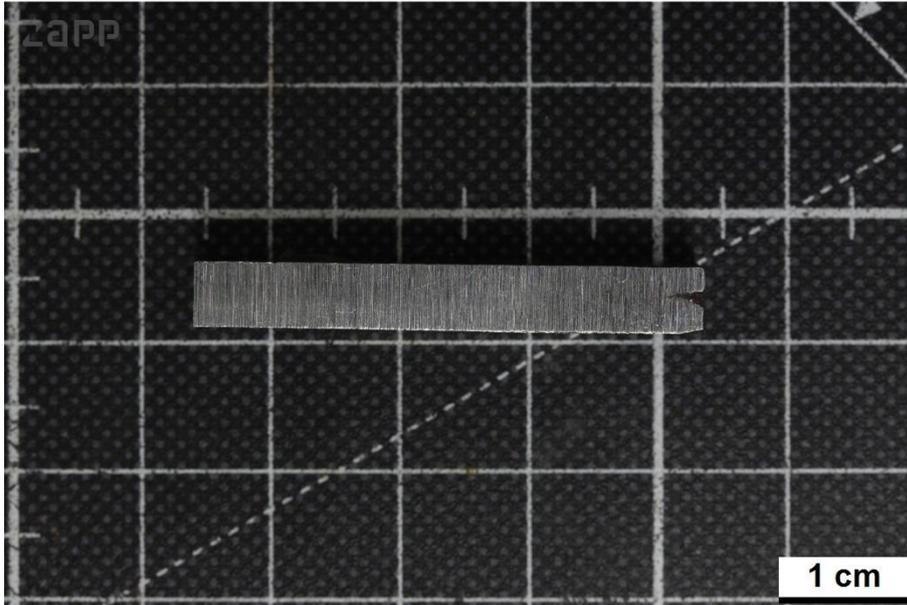


Illustration: 1

Etching:

Cut-No.:

Sample Location:

Remarks:

Pattern overview Sample 2

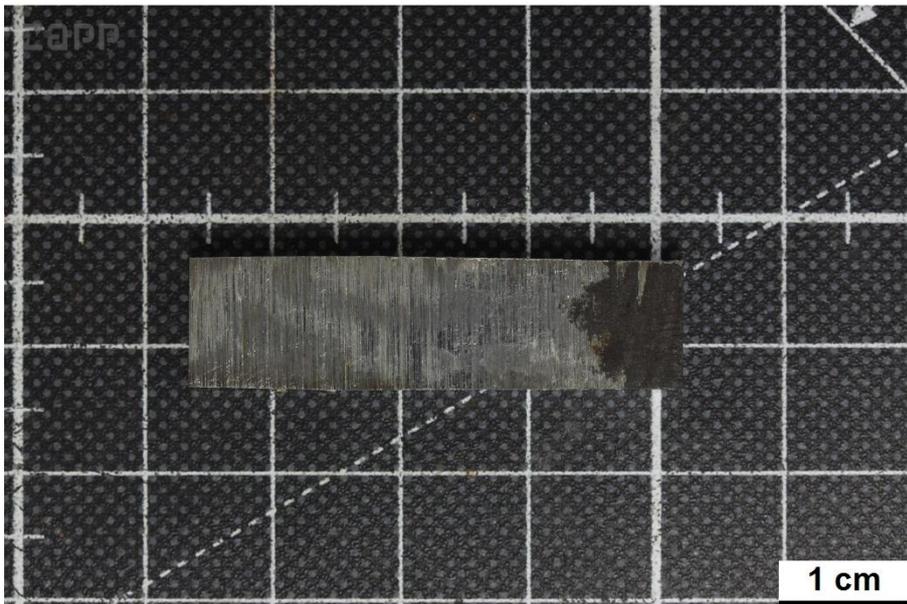


Illustration: 2

Etching:

Cut-No.:

Sample Location:

Remarks:

Pattern overview Sample 2

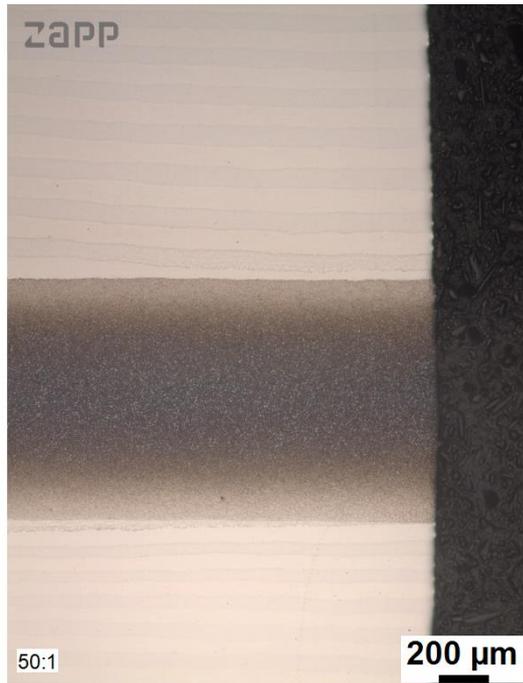


Illustration: 3
Etching: nital
Cut-No.: 6303
Sample Location: cross section

Remarks:

Parent material
_unterschiedliche bright layers

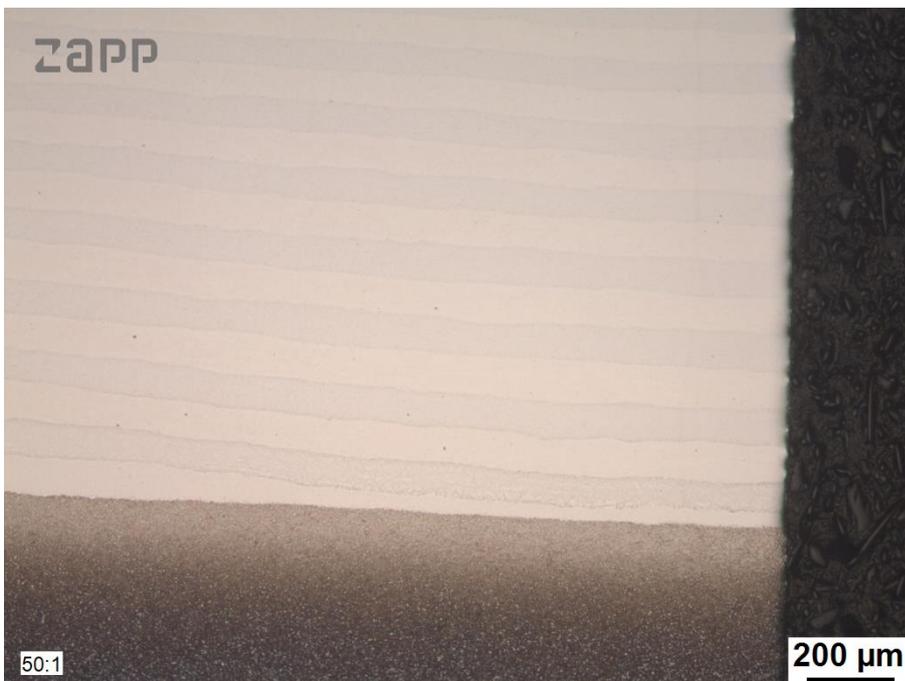


Illustration: 4
Etching: nital
Cut-No.: 6303
Sample Location: cross section

Remarks:

Parent material
_unterschiedliche bright layers

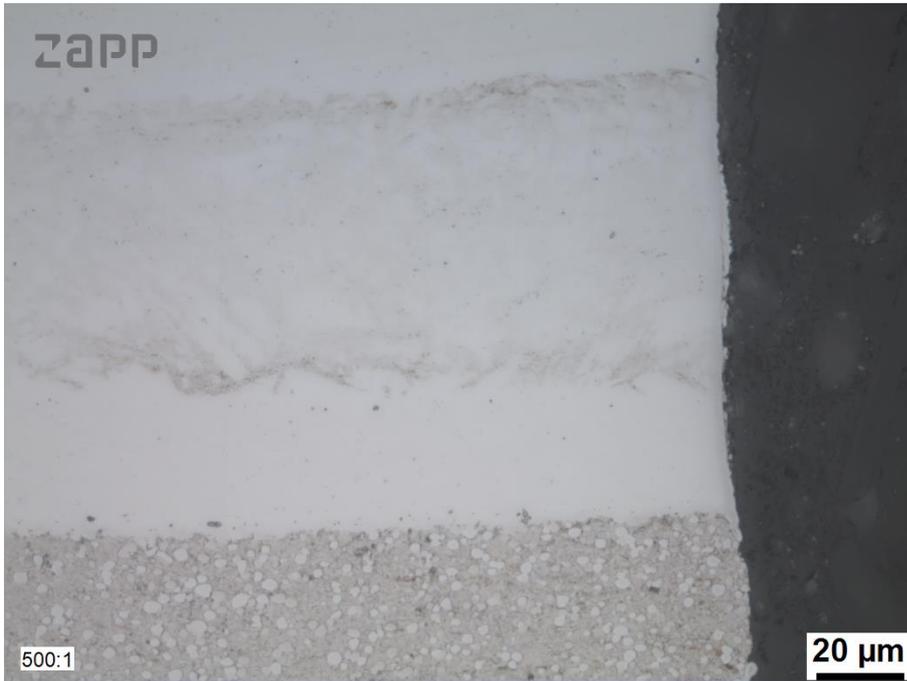


Illustration: 5
Etching: nital
Cut-No.: 6303
Sample Location: cross section

Remarks:

_OBEN: bright different layers

_unten: PM Location

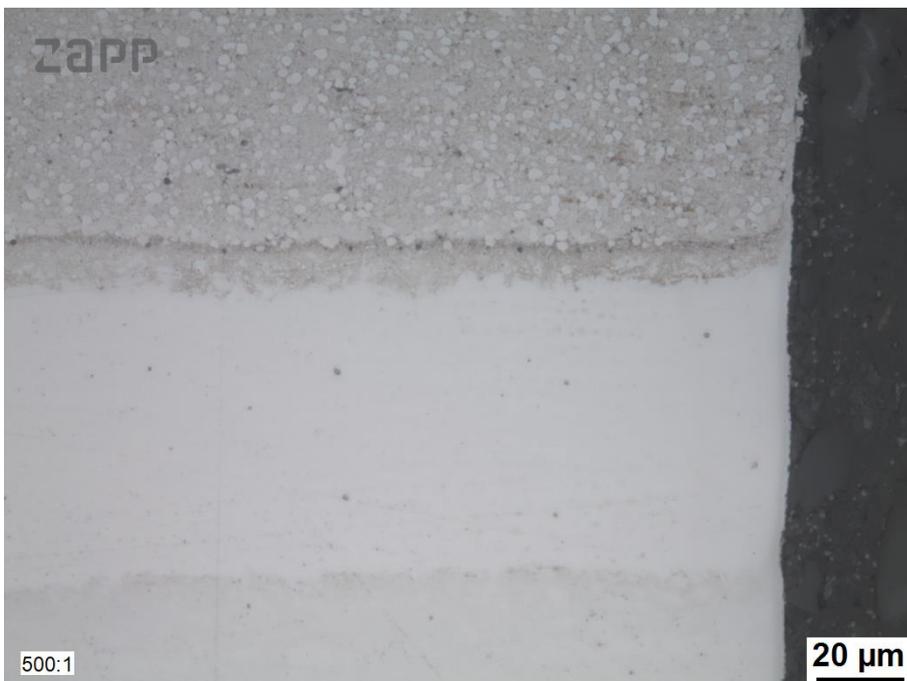


Illustration: 6
Etching: nital
Cut-No.: 6303
Sample Location: cross section

Remarks:

_unten: bright different layers

_OBEN: PM-capable recognizable diffusion zone



Illustration: 7
 Etching: Recipe 104 (ASTM E407)
 Cut-No.: 6303
 Sample Location: cross section

Remarks:

Parent material

_Übersicht of the different layers

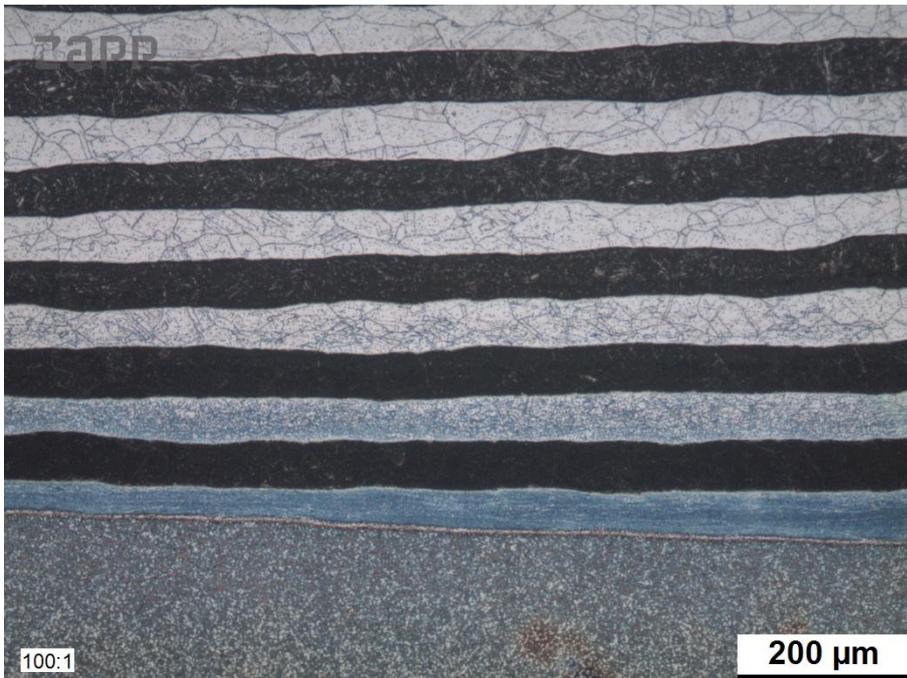


Illustration: 8th
 Etching: Recipe 104 (ASTM E407)
 Cut-No.: 6303
 Sample Location: cross section

Remarks:

Overview:

_from bottom to top: PM-zone -> carbide-light situation -> Martensitlage -> ...

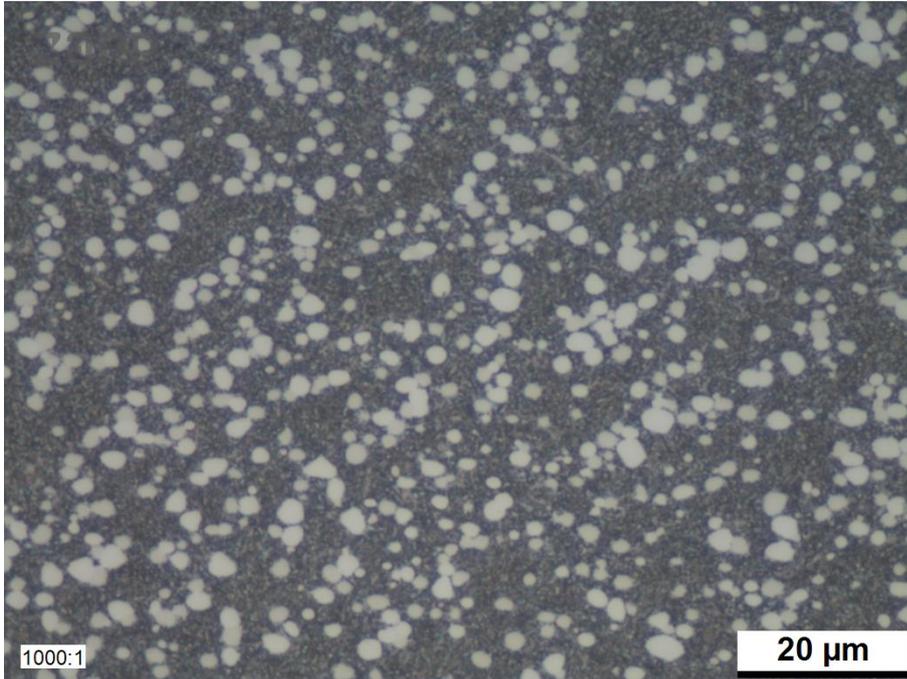


Illustration: 9
Etching: Recipe 104 (ASTM E407)
Cut-No.: 6303
Sample Location: cross section

Remarks:

PM Location:

_Carbide in martensitic matrix

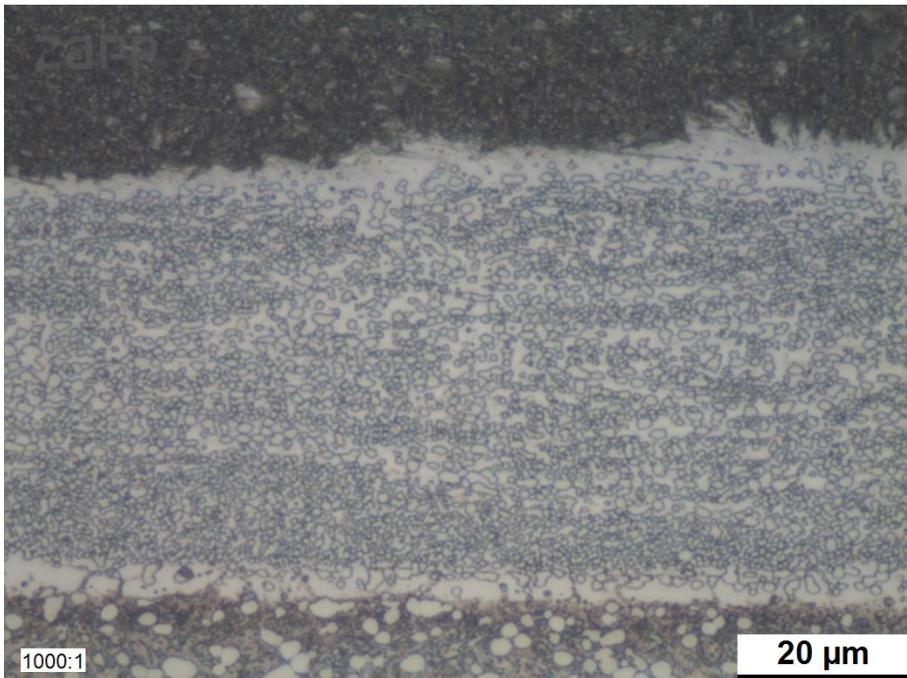


Illustration: 10
Etching: Recipe 104 (ASTM E407)
Cut-No.: 6303
Sample Location: cross section

Remarks:

Transition area PM

_erste carbide-rich light layer

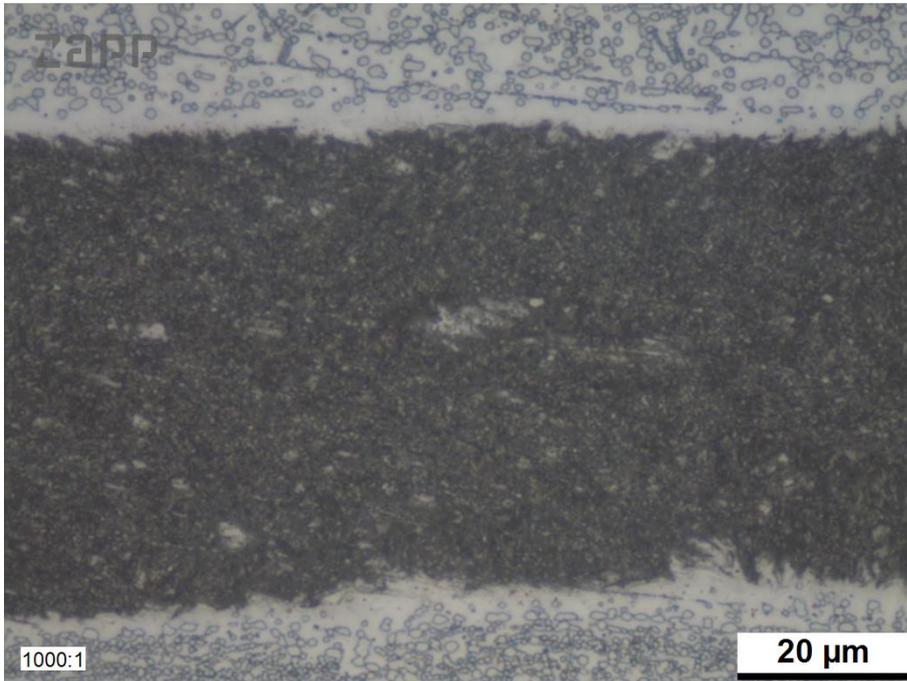


Illustration: 11
Etching: Recipe 104 (ASTM E407)
Cut-No.: 6303
Sample Location: cross section

Remarks:

_erste martensitic location

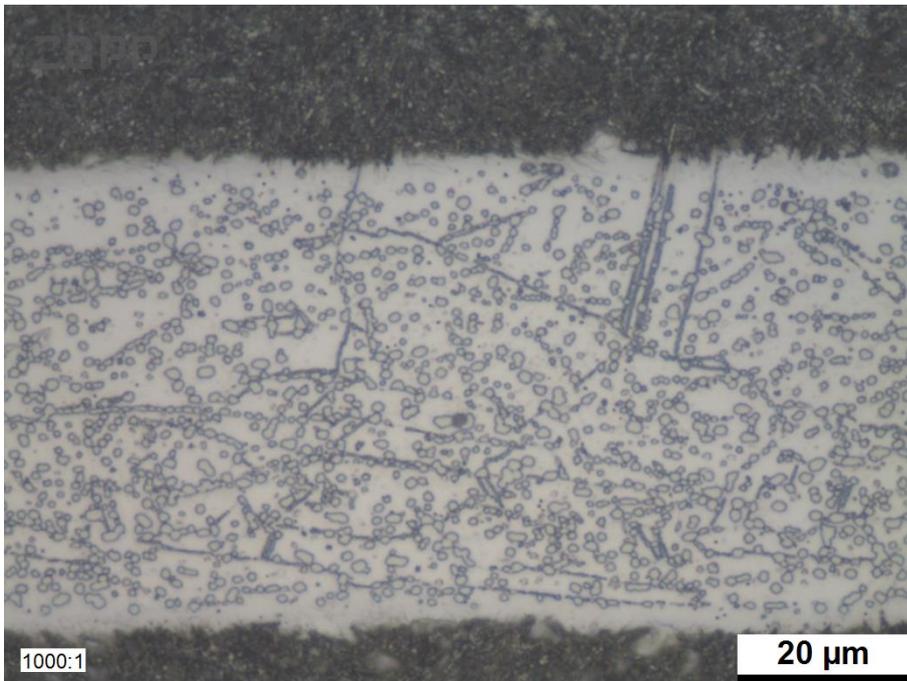


Illustration: 12
Etching: Recipe 104 (ASTM E407)
Cut-No.: 6303
Sample Location: cross section

Remarks:

_zweite bright location

_weniger Carbide as a prime location

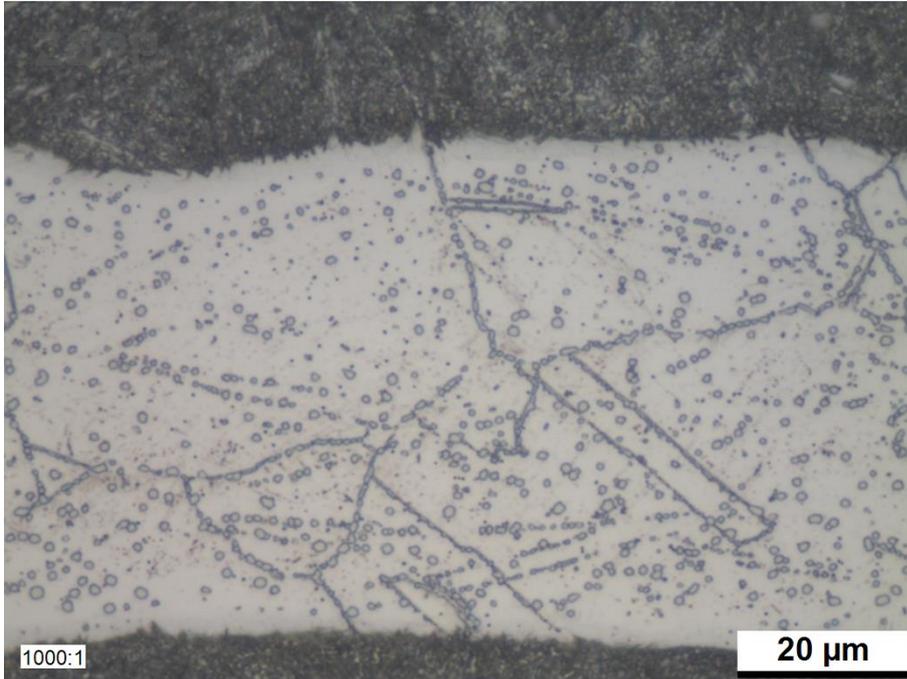


Illustration: 13
Etching: Recipe 104 (ASTM E407)
Cut-No.: 6303
Sample Location: cross section

Remarks:

- _dritte bright location
- _Gehalt of carbides decreases

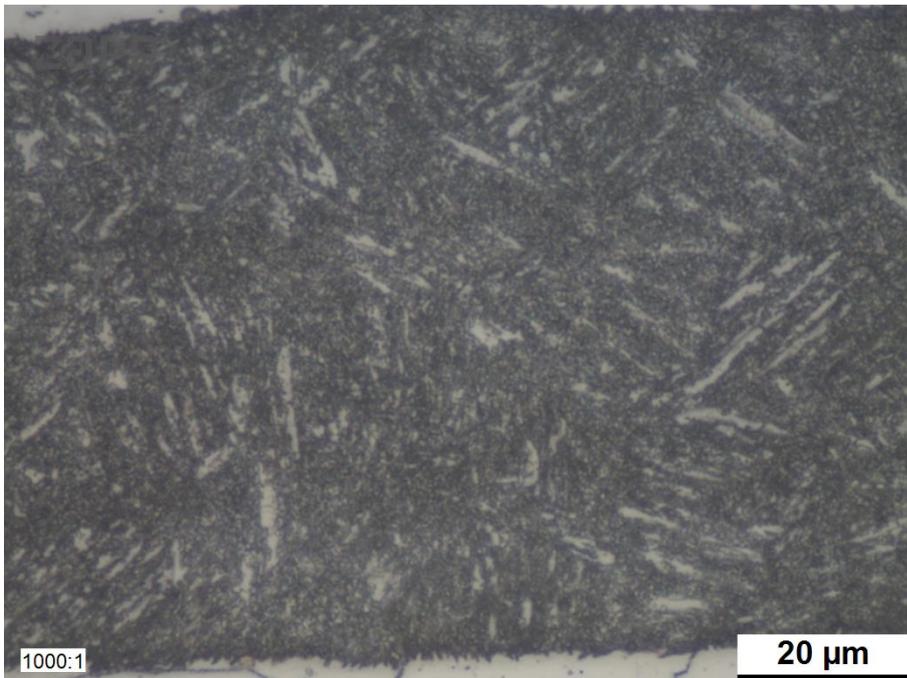


Illustration: 14
Etching: Recipe 104 (ASTM E407)
Cut-No.: 6303
Sample Location: cross section

Remarks:

- _martensitische location in the edge area
- _helle needle structure recognizable

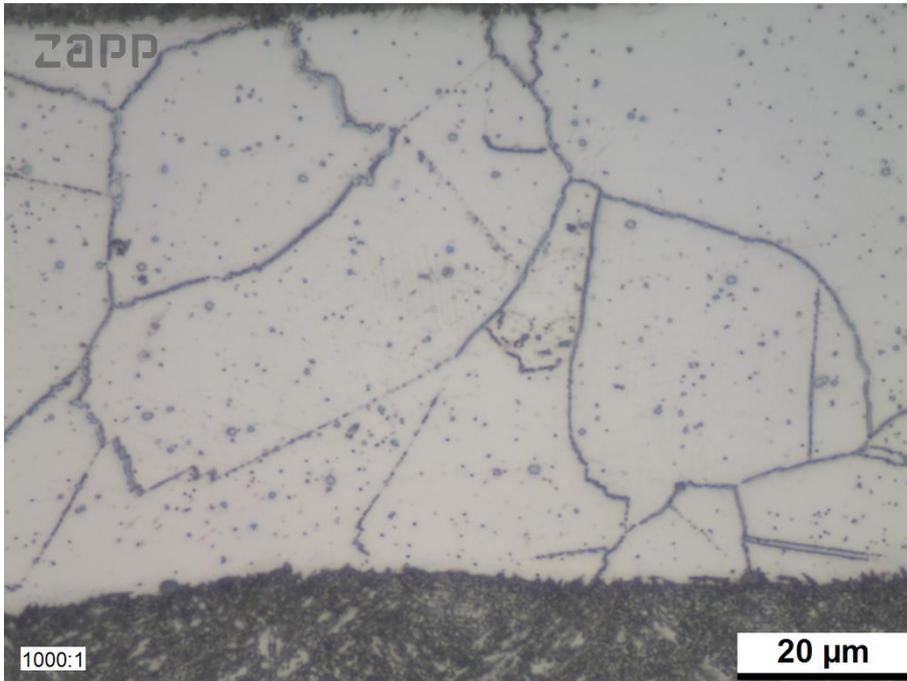


Illustration: 15
Etching: Recipe 104 (ASTM E407)
Cut-No.: 6303
Sample Location: cross section

Remarks:

- _helle position in the edge area
- _geringer carbide

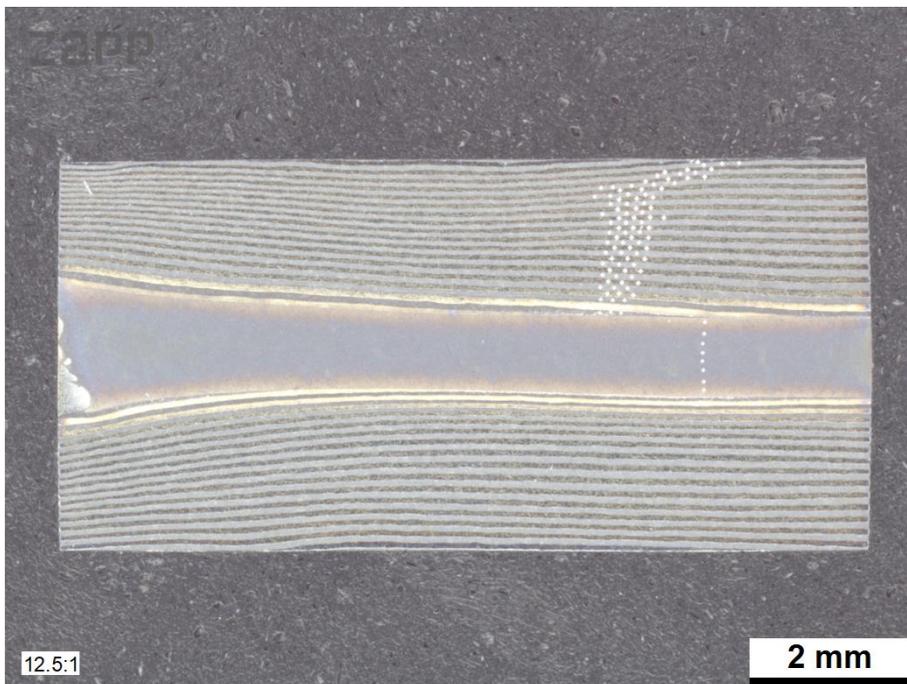


Illustration: 16
Etching: Recipe 104 (ASTM E407)
Cut-No.: 6303
Sample Location: cross section

Remarks:

- Parent material
- _Lagen with hardness indentations

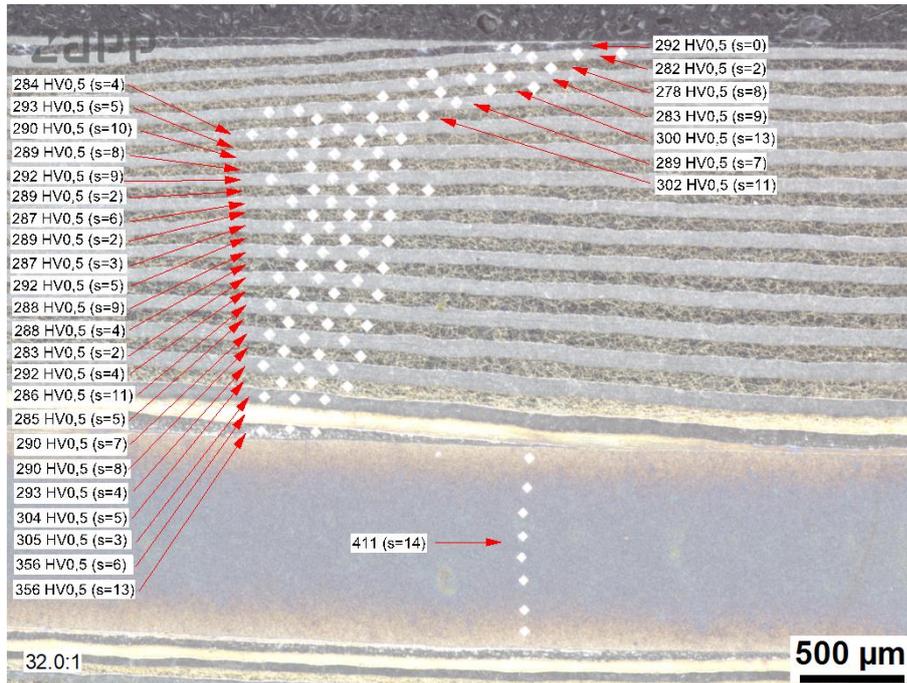


Illustration: 17
 Etching: Recipe 104 (ASTM E407)
 Cut-No.: 6303
 Sample Location: cross section

Remarks:

Parent material

_ Layers with hardness indentations