

Aerospace series — Macrostructure of titanium and titanium alloy wrought products

**Part 002: Macrostructure of bar,
section, forging stock and forgings**

ICS 49.025.30

National foreword

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Luft- und Raumfahrt - Makrostruktur von geschmiedeten Erzeugnissen aus Titan und Titanlegierungen - Teil 002: Makrostruktur von Stangen, Profilen, Schmiedevormaterial und Schmiedestücken

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Foreword

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1 Scope

This European Standard contains pictures of the macrostructure of bar, section, forging stock and forgings for titanium and titanium alloy wrought products.

This European Standard shall be used in conjunction with EN 2954-001.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 2954-001, *Aerospace series — Macrostructure of titanium and titanium alloy wrought products — Part 001: General requirements.*

3 Macrographs

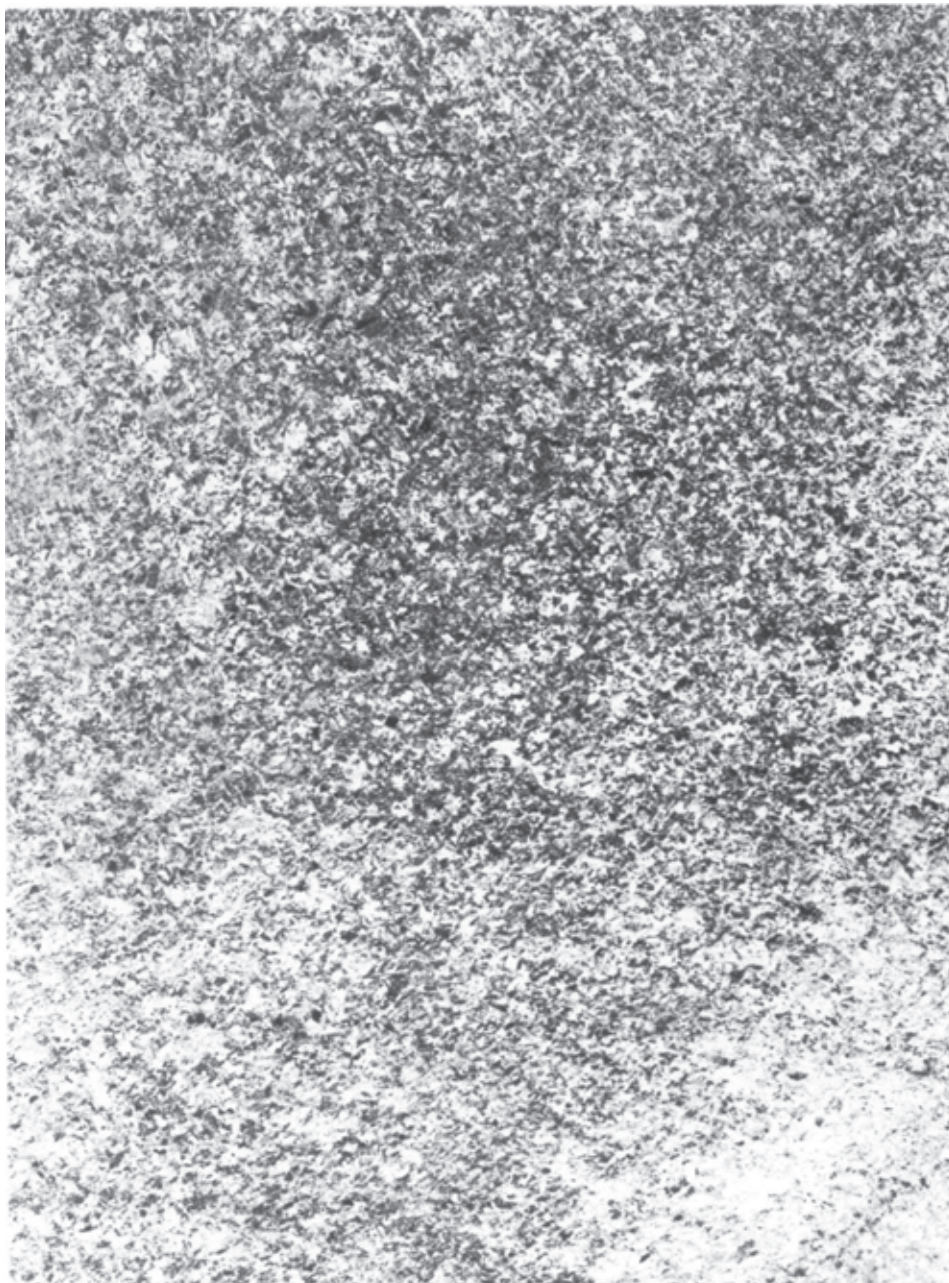
All macrographs are shown at actual size ($\times 1$ magnification) when printed without any magnification or reduction. See Annex A (normative).

Annex A (normative)

Atlas of macrographic references

A.1 Macro grain size

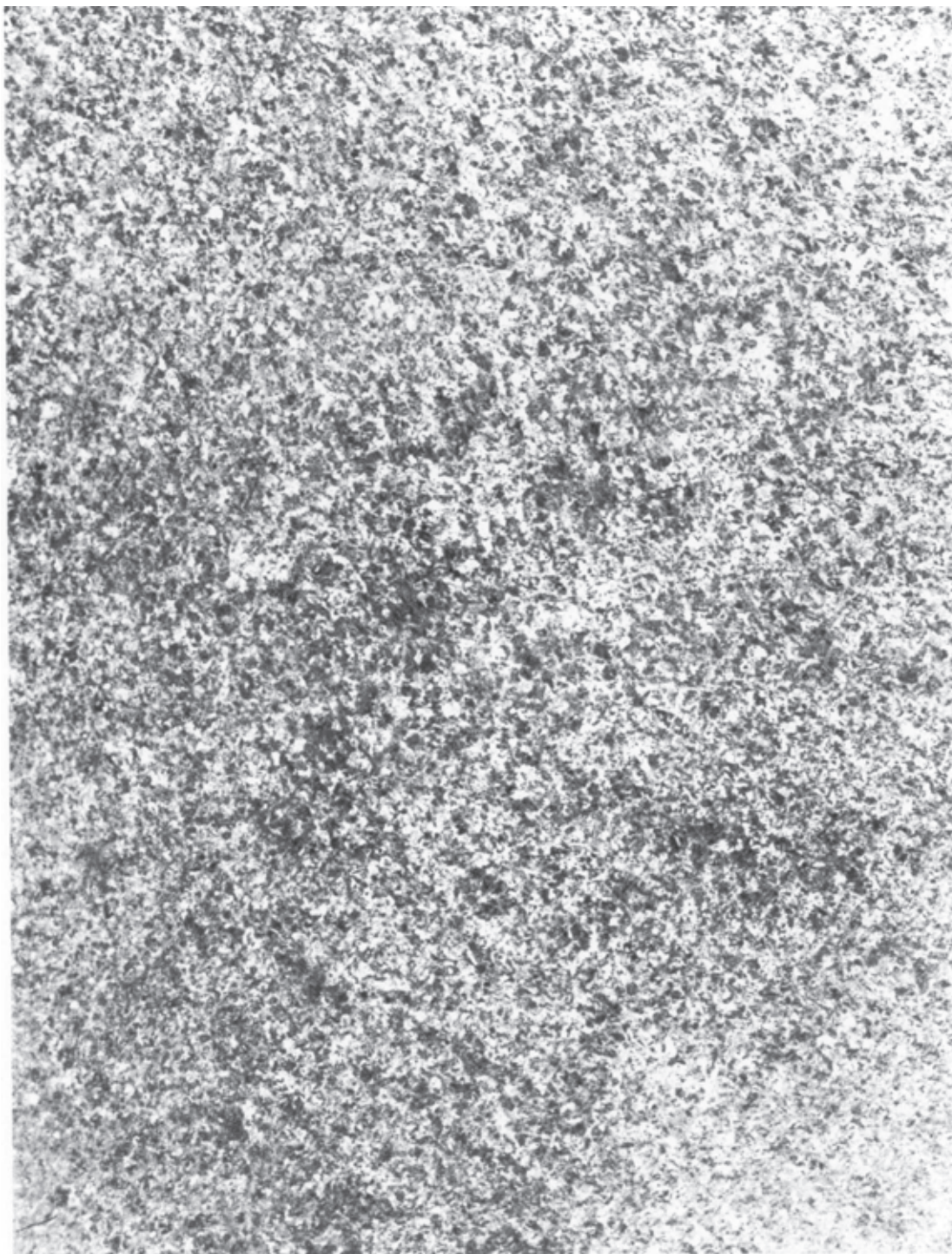
See Figure A.1 (2MA1 to 2MA6). ¹⁾



2MA1

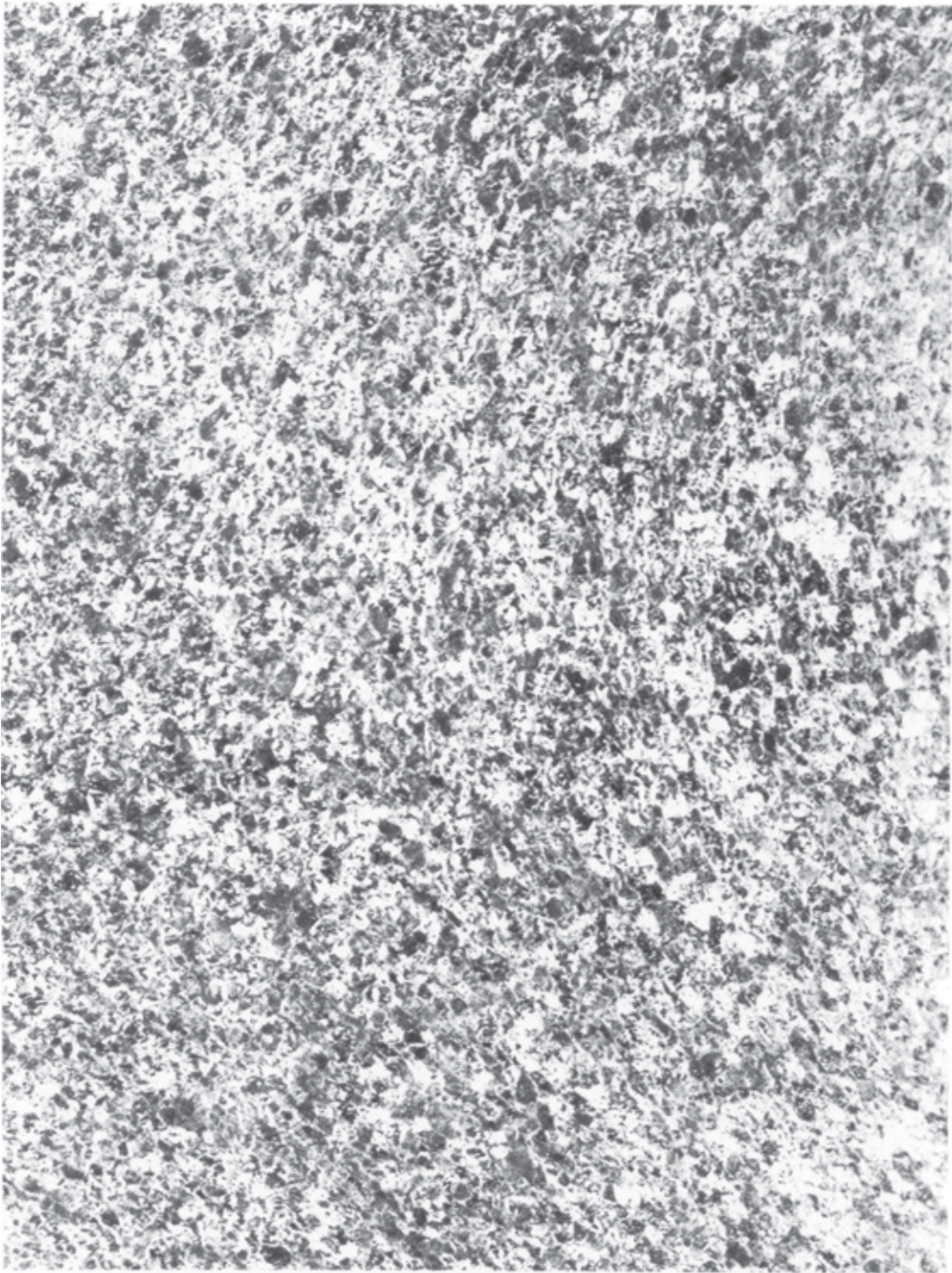
Level 10

1) Additional indication from publication ETTC 3.



2MA2

Level 20



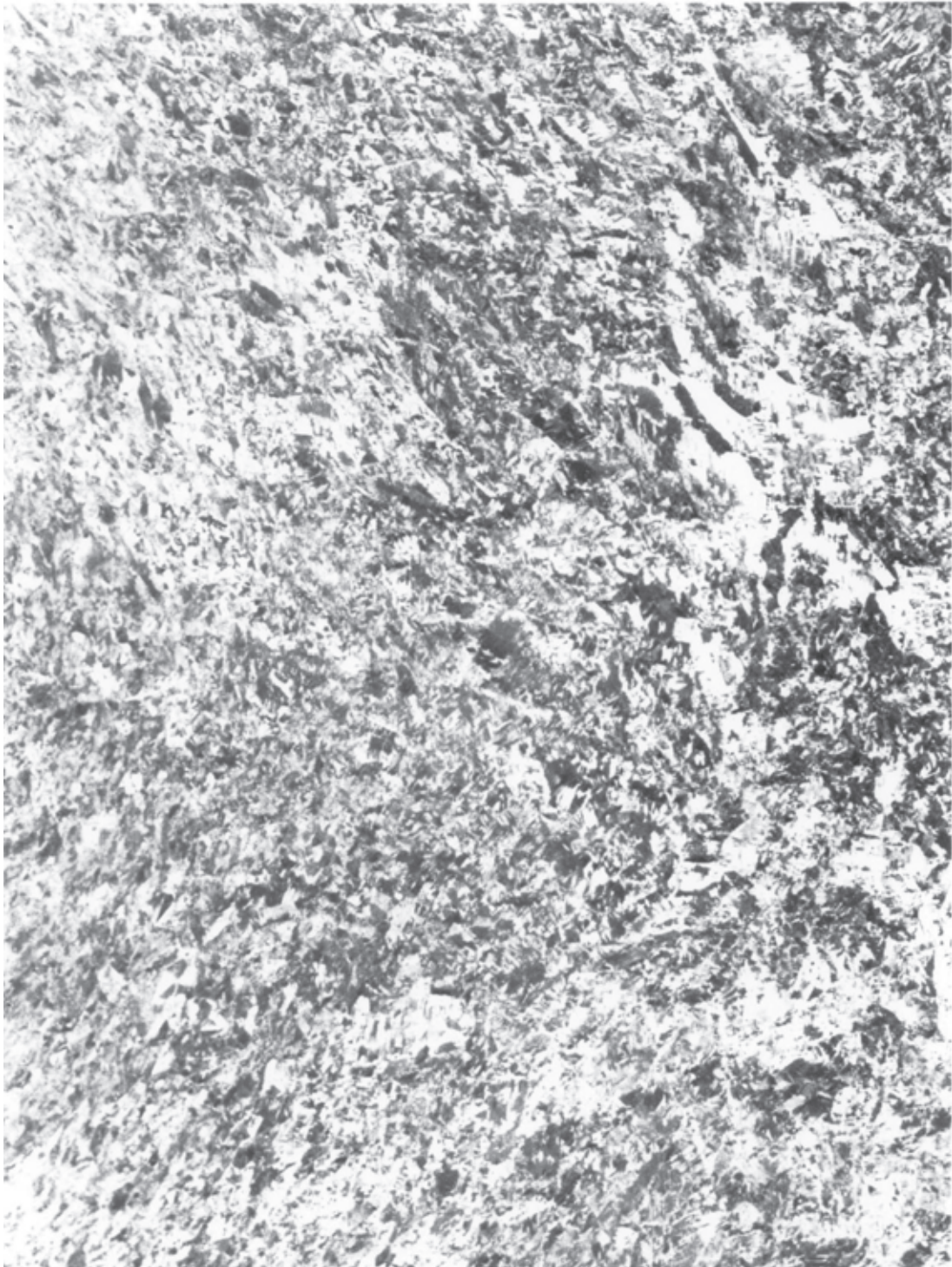
2MA3

Level 30



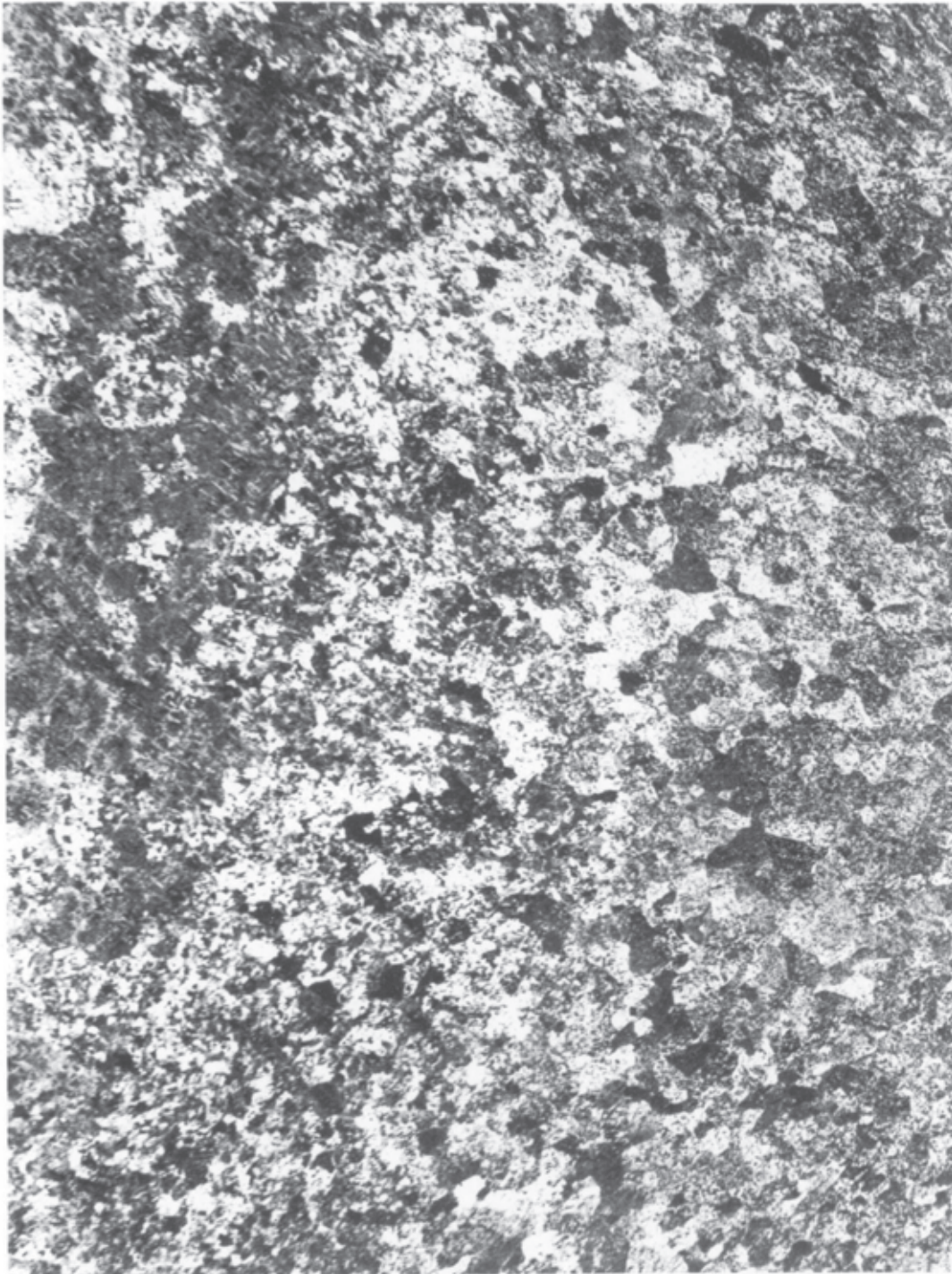
2MA4

Level 40



2MA5

Level 50



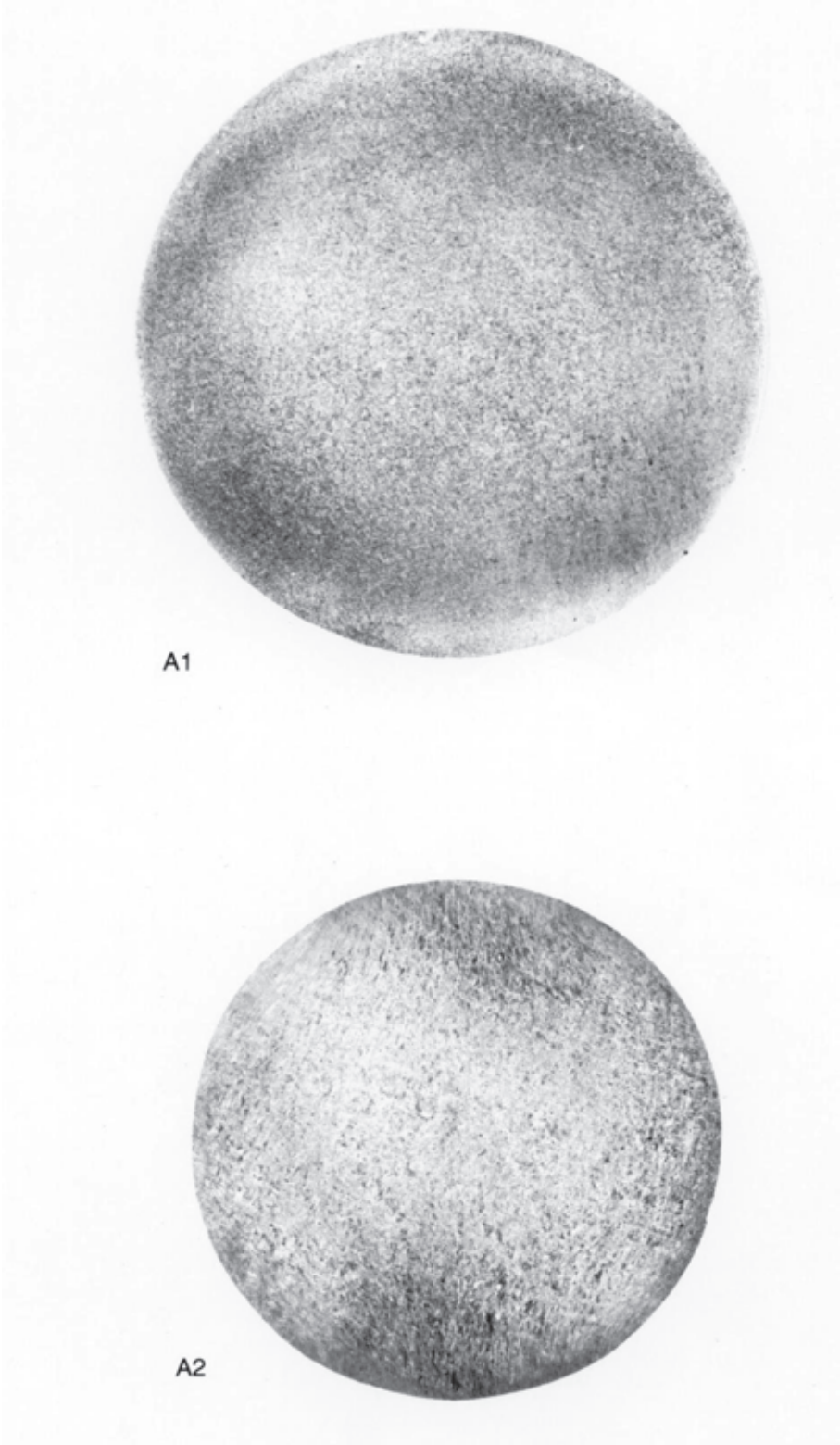
2MA6

Level 60

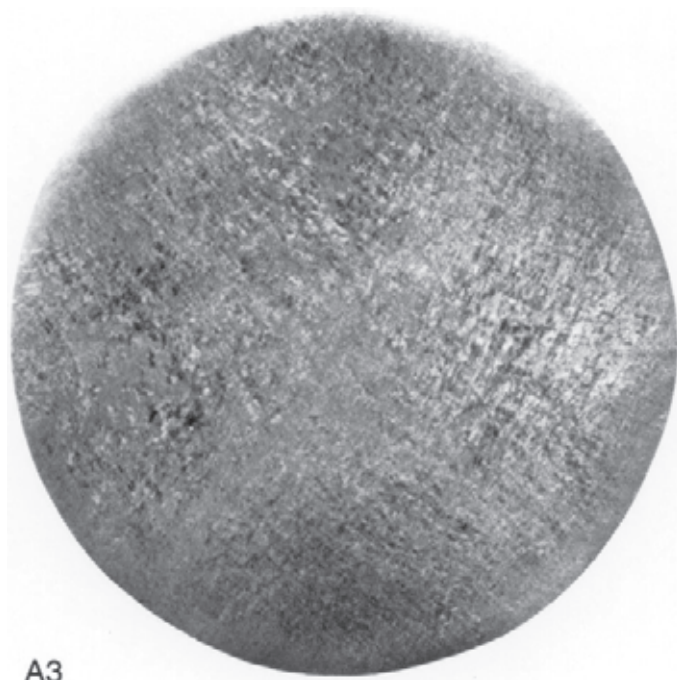
Figure A.1

A.2 Non-uniform macrostructure

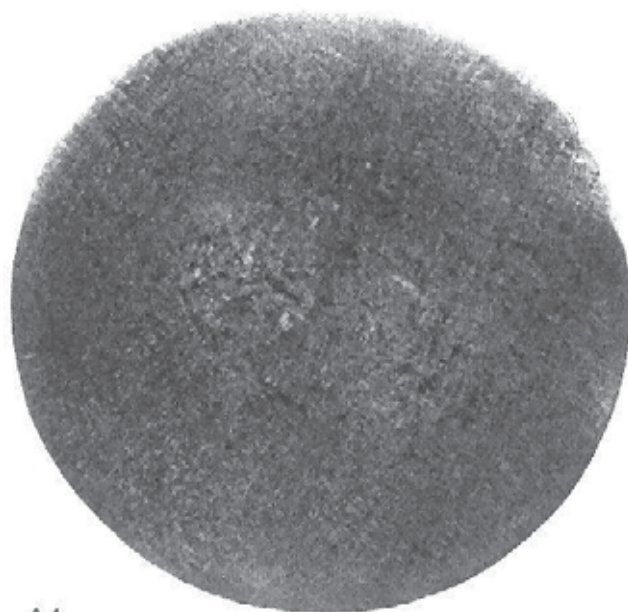
See Figure A.2 (2MA20 to 2MA25). ¹⁾



2MA20

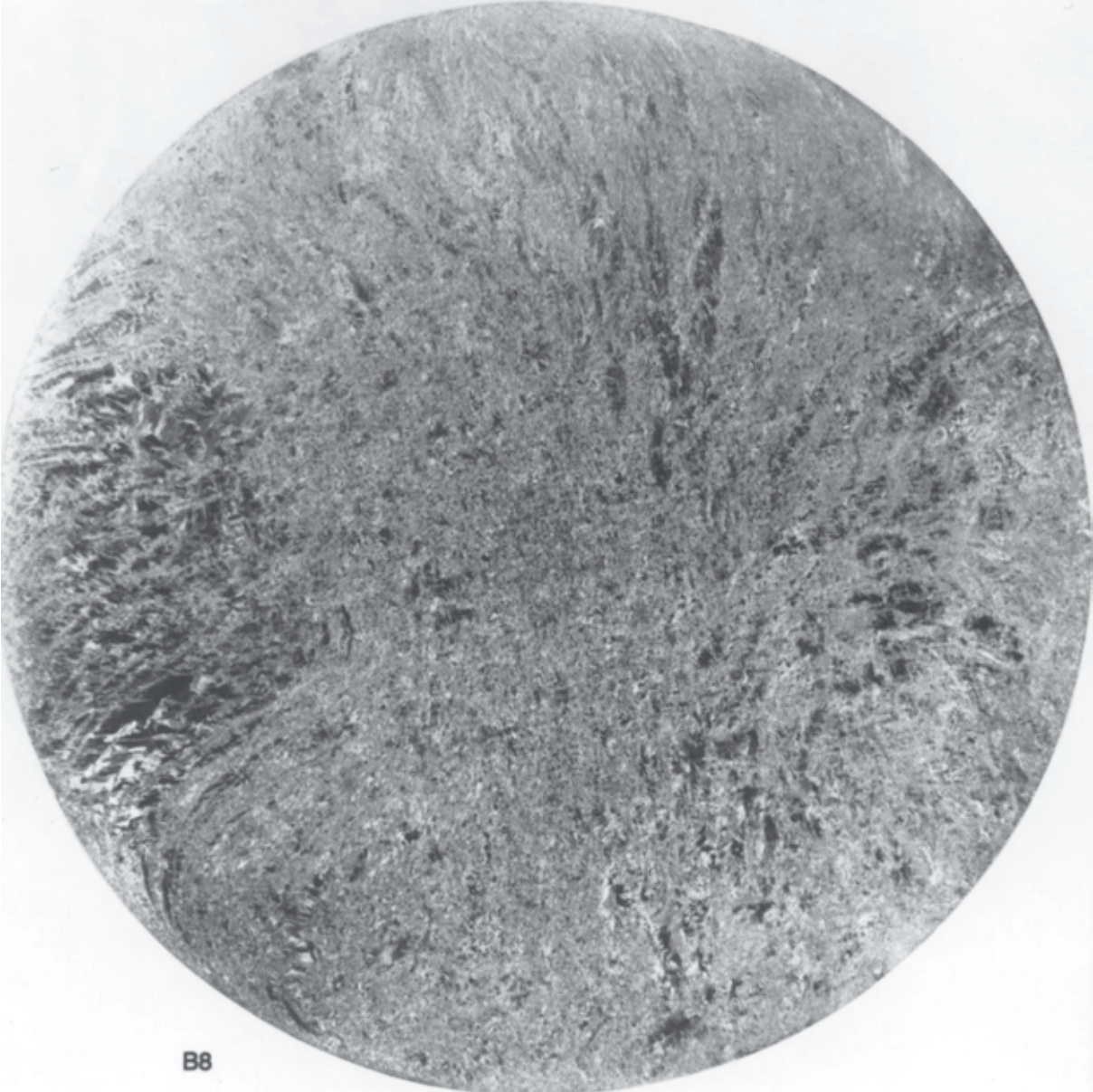


A3



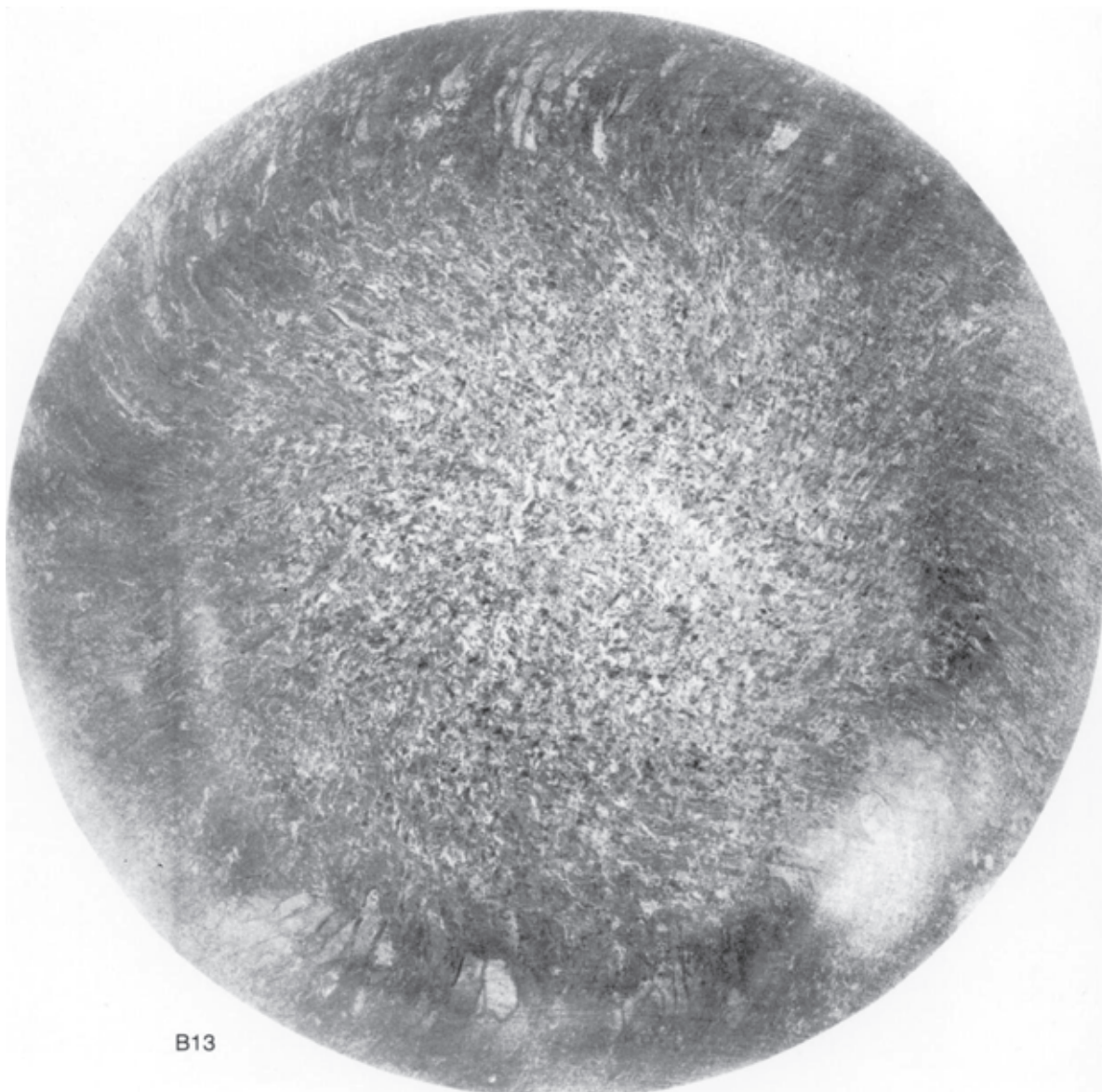
A4

2MA21



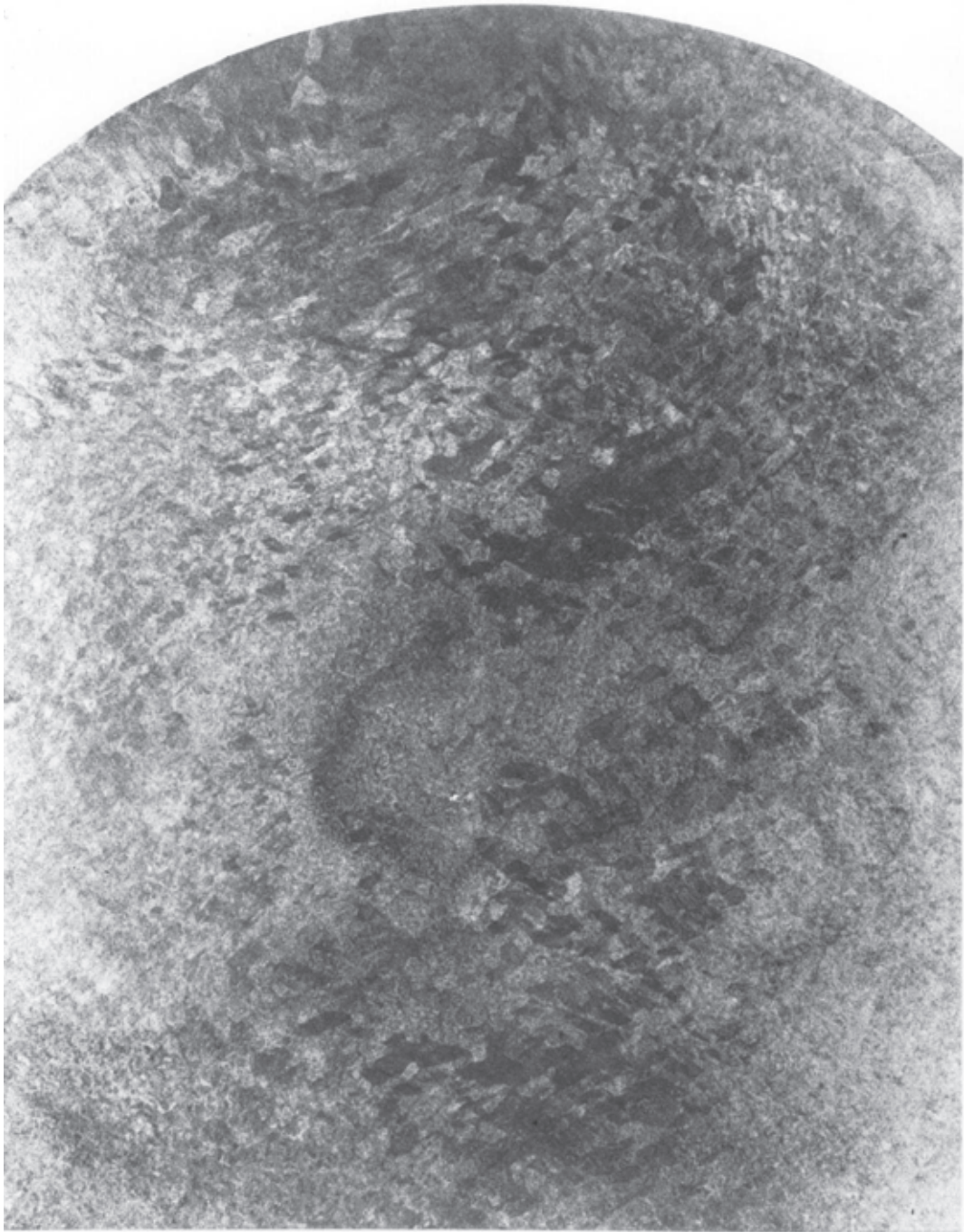
B8

2MA22

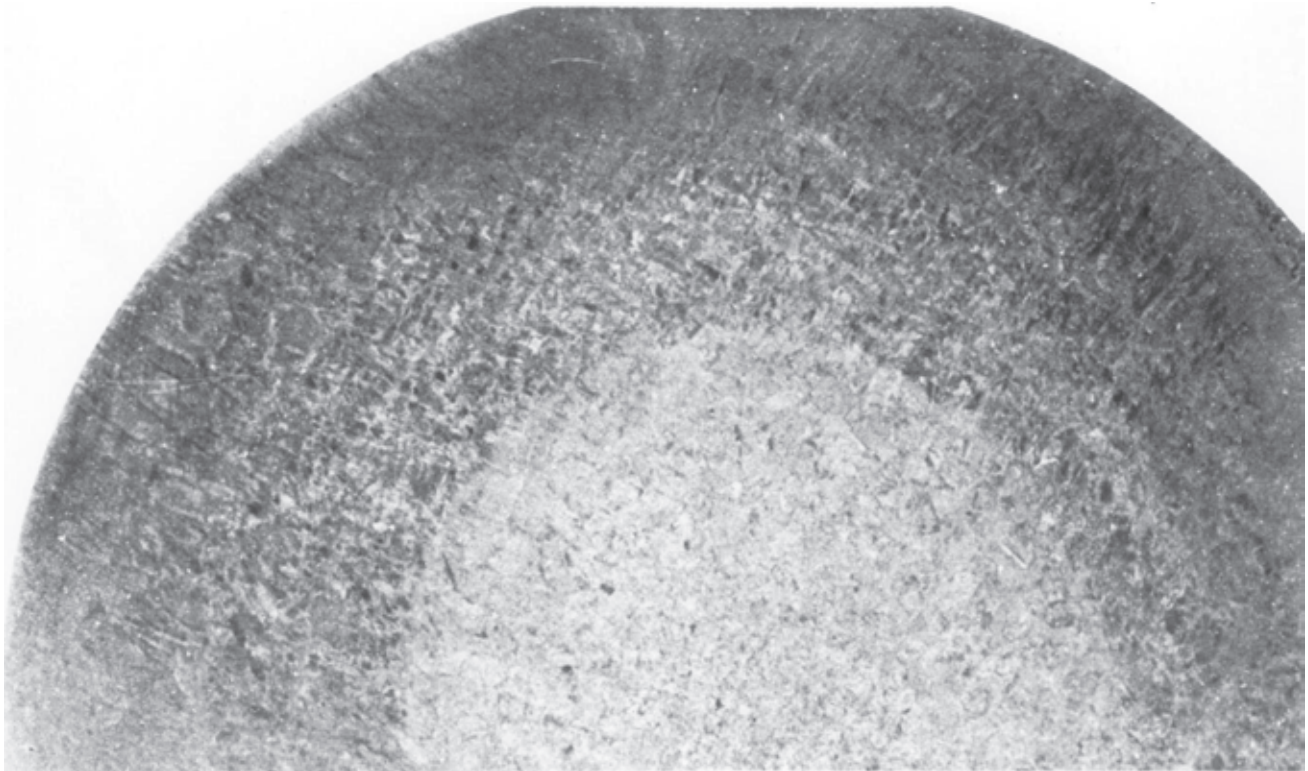


B13

2MA23



2MA24

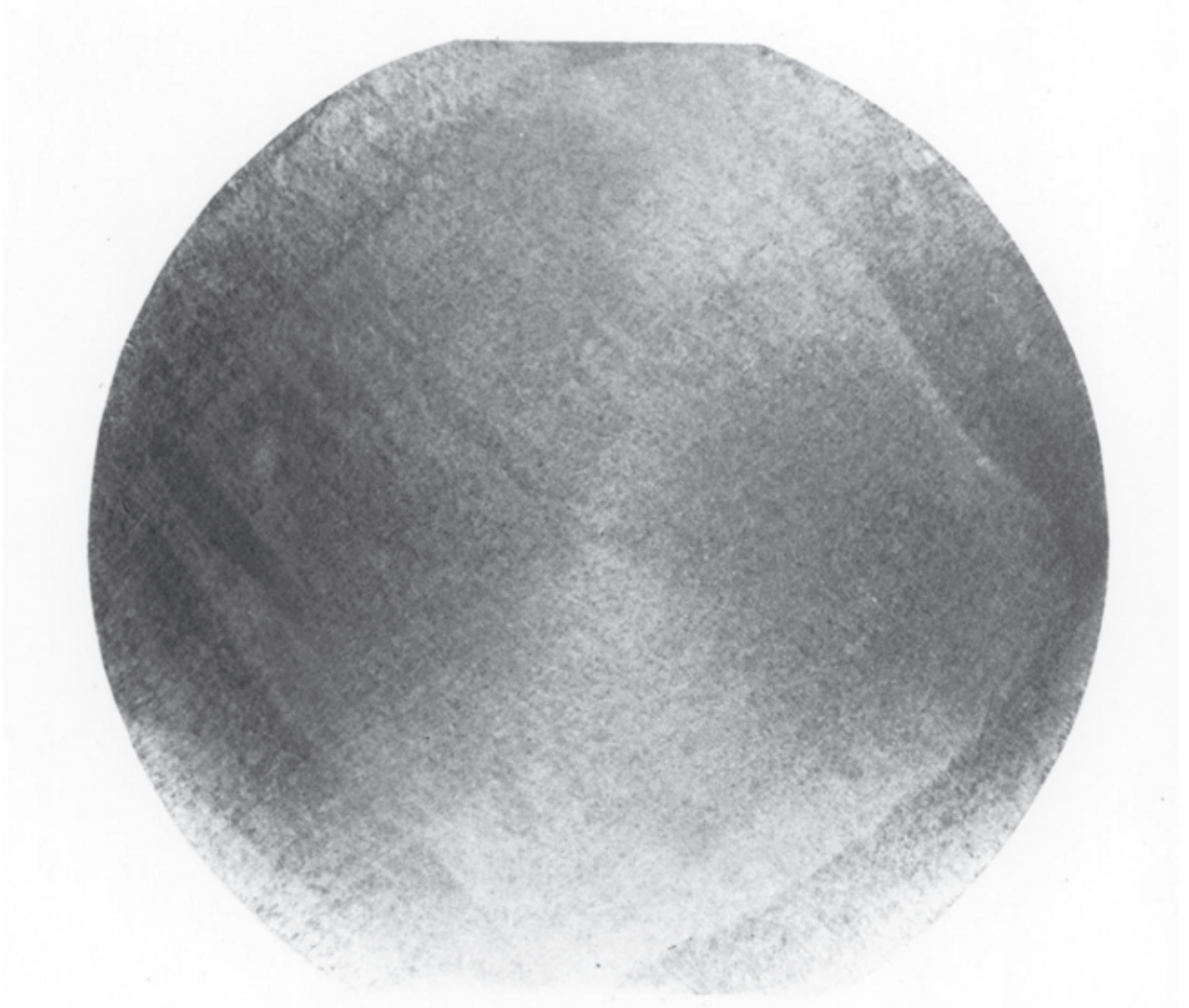


2MA25

Figure A.2

A.3 Tree-ring type structures

See Figure A.3 (2MA40 to 2MA42). ¹⁾



2MA40

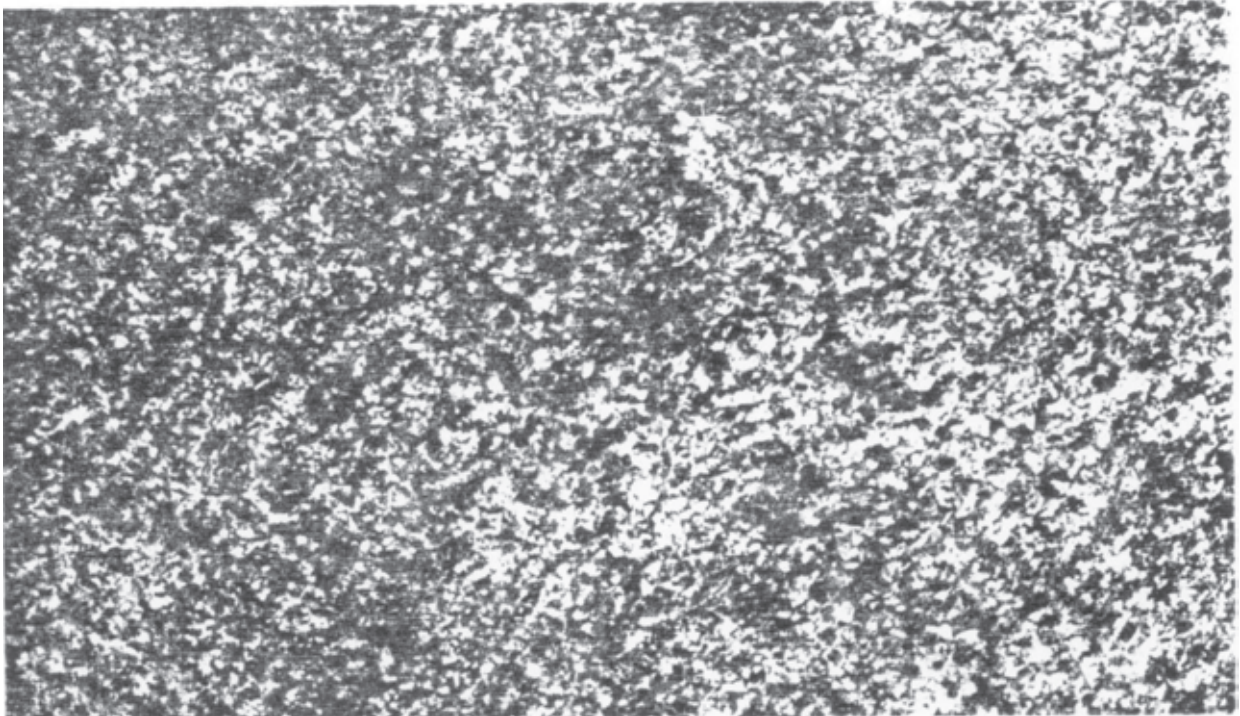


2MA41 and 2MA42

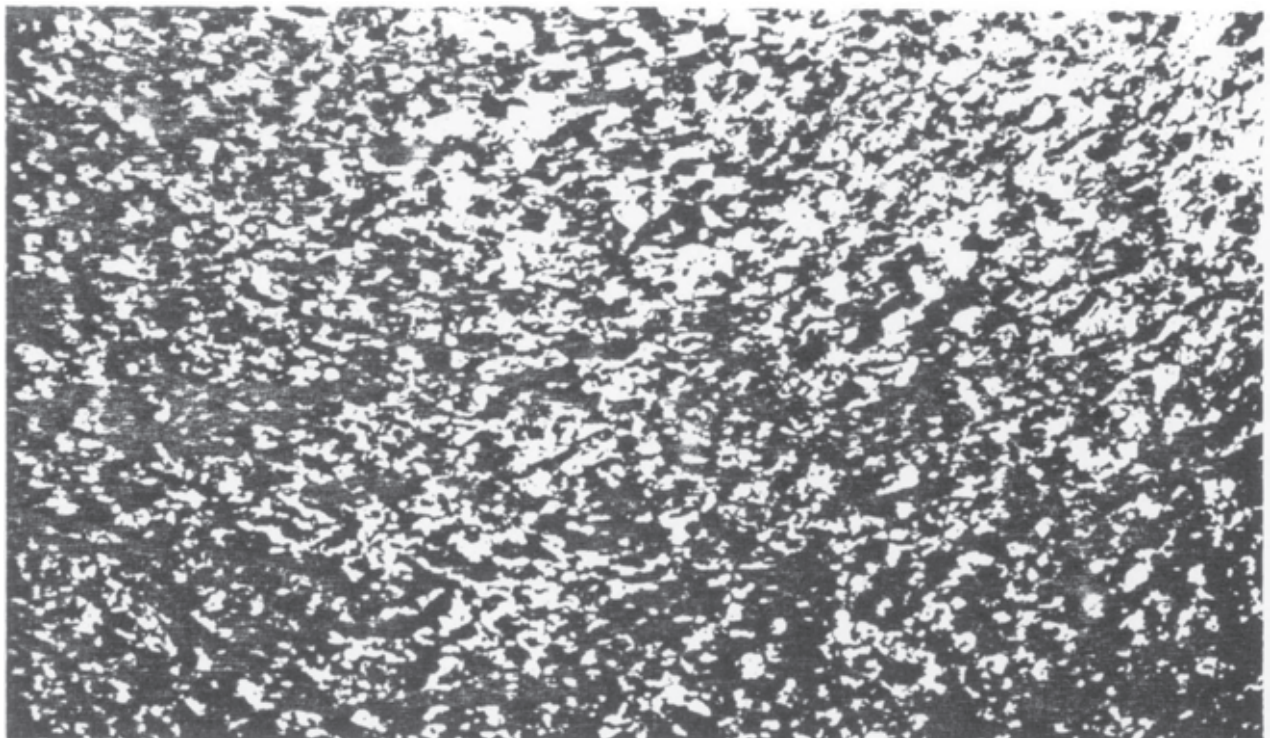
Figure A.3

A.4 Macro grain size for common alpha-beta forgings

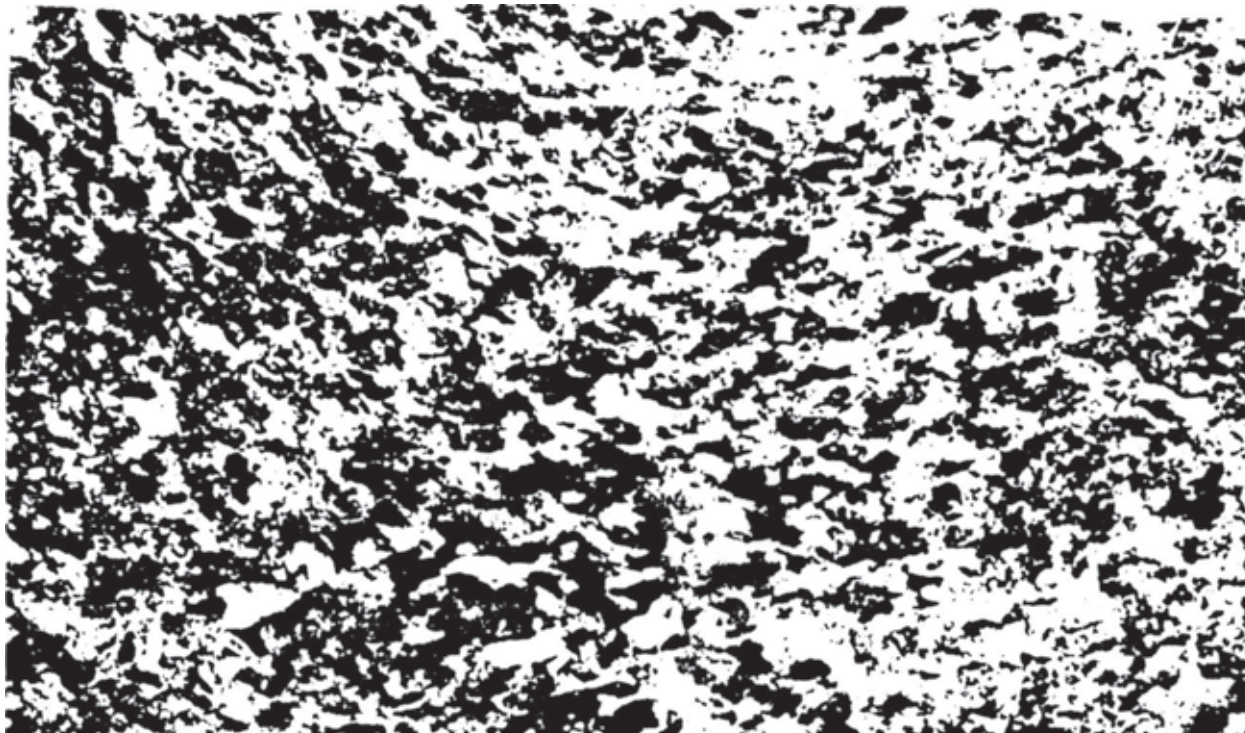
See Figure A.4 (2MA60 to 2MA62).



2MA60



2MA61



2MA62

Figure A.4

A.5 Macrostructure obscured by grain flow

See Figure A.5 (2MA70).



2MA70

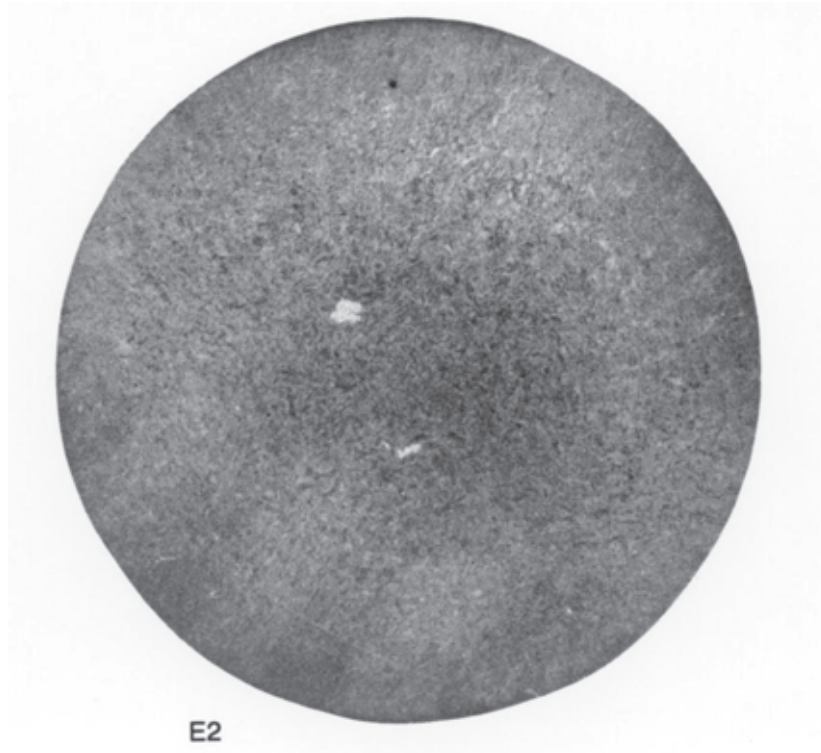
Figure A.5

A.6 Alpha segregates, alpha stringer or blocky alpha

See Figure A.6 (2MA80 to 2MA84). ¹⁾

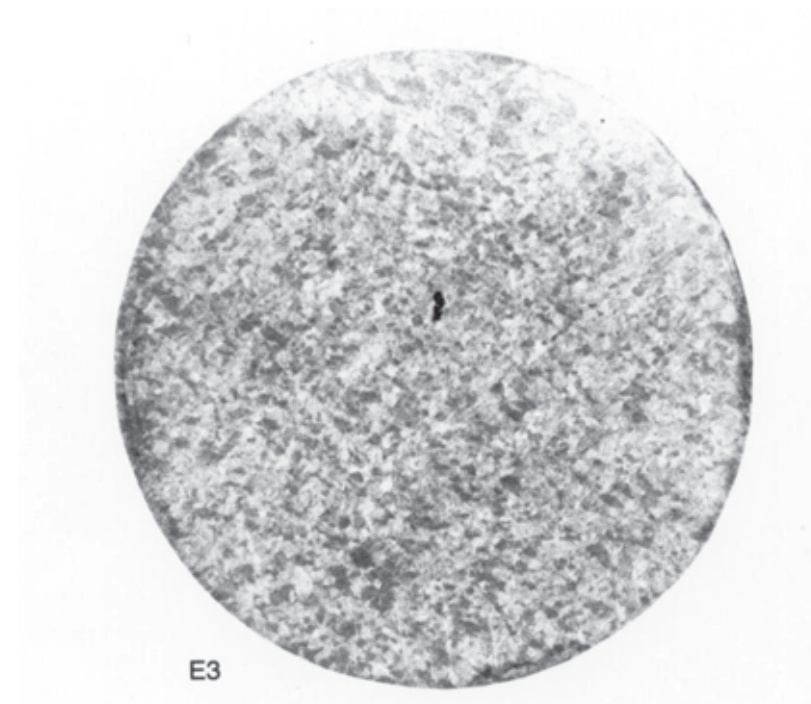


2MA80 — Alpha segregates, alpha stringer



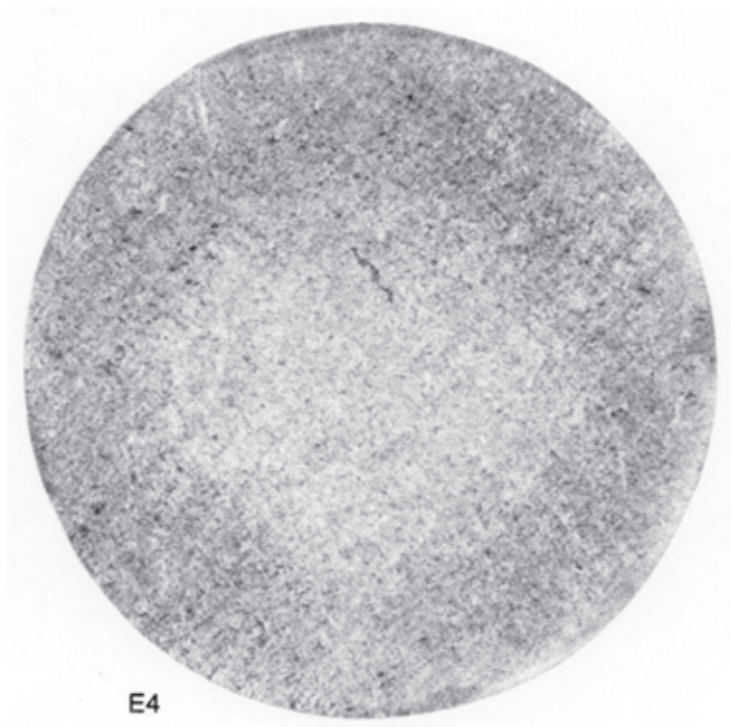
E2

2MA81 — Alpha segregates, blocky alpha

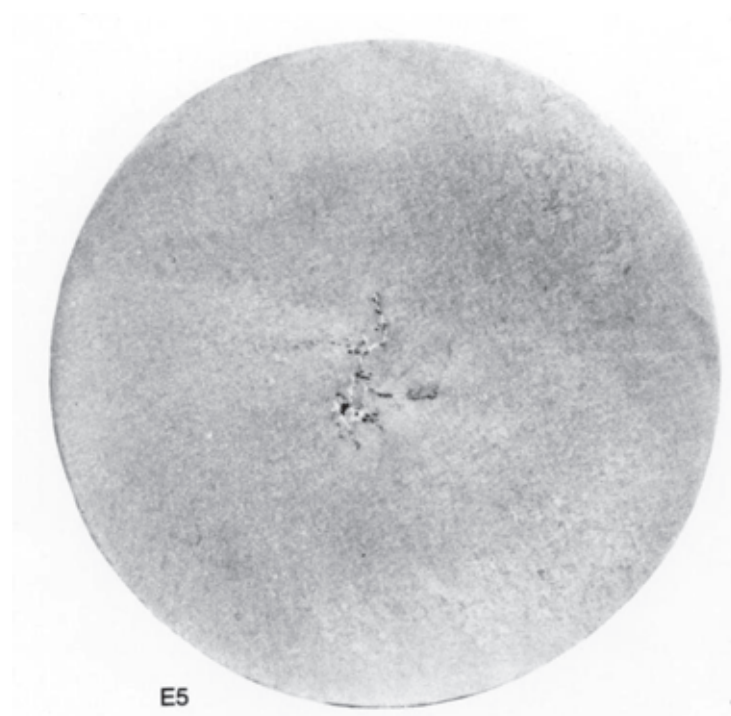


E3

2MA82 — Alpha segregates, blocky alpha



2MA83 — Alpha segregates, blocky alpha

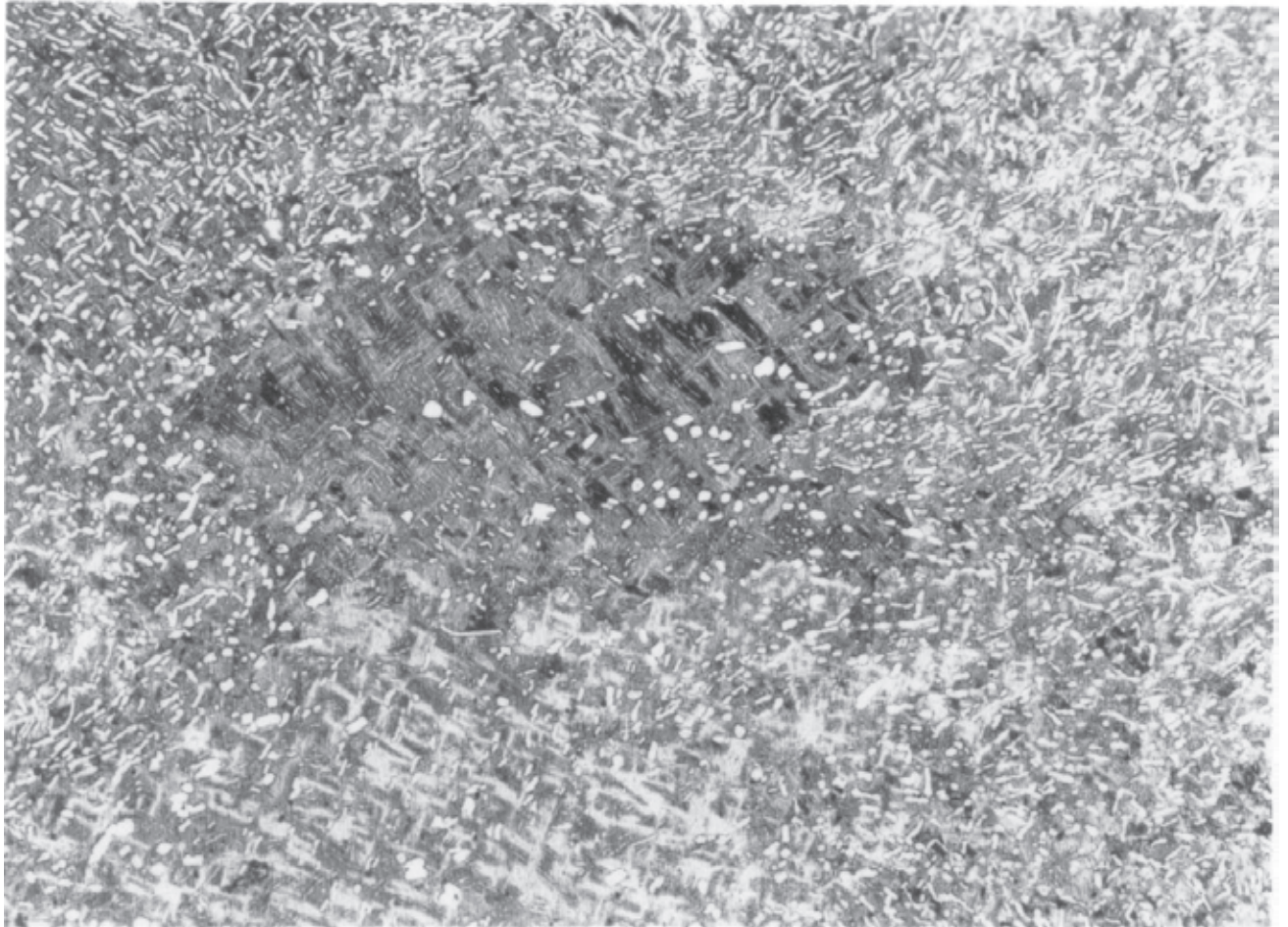


2MA84 — Alpha segregates, blocky alpha

Figure A.6

A.7 Beta fleck

See Figure A.7 (2MA100).



2MA100

Figure A.7

Bibliography

- [1] AMS 2380, *Approval and control of premium-quality titanium alloys.*

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