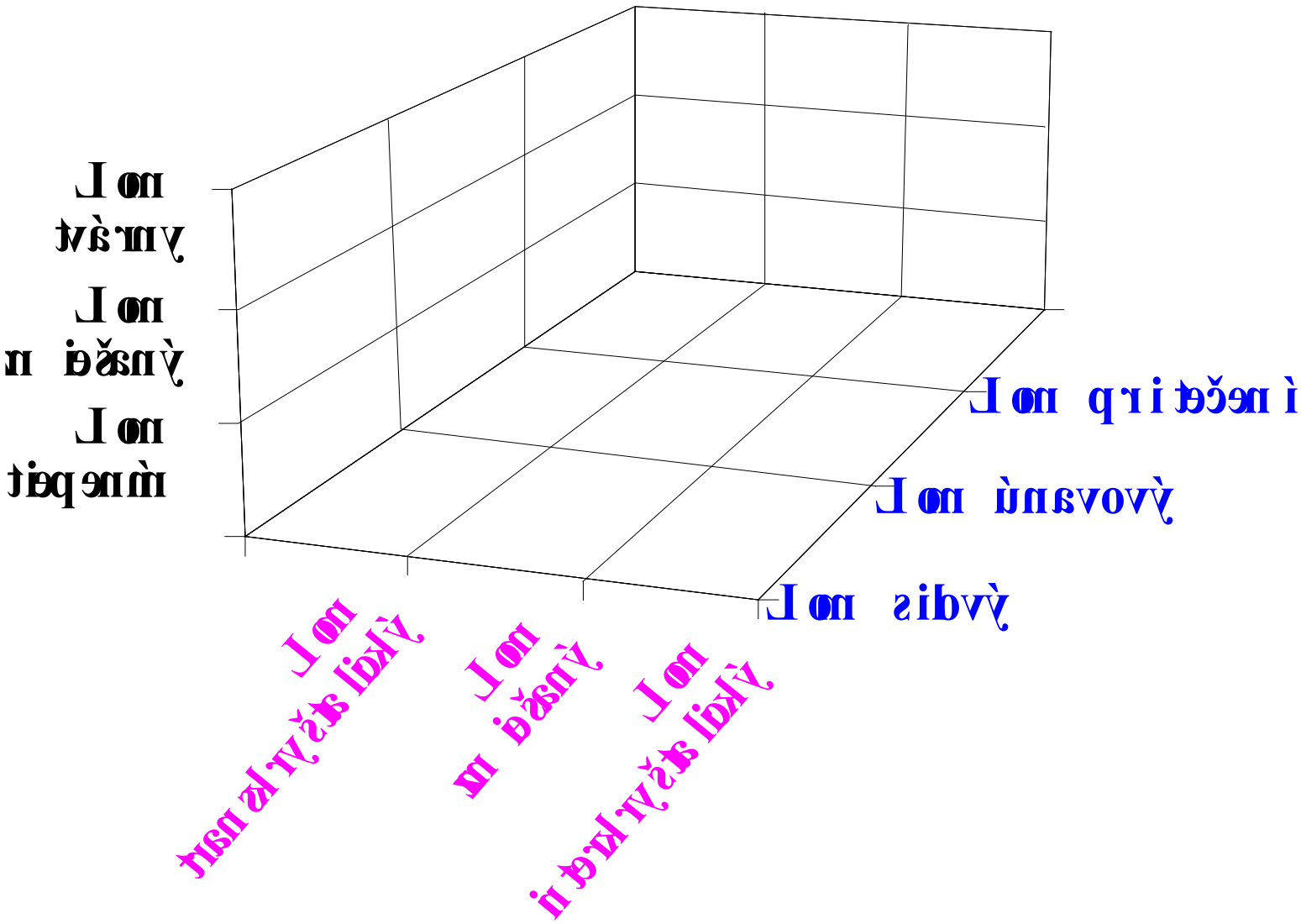
Vznik a šírenie lomu

Základné rozdelenie lomov



Interkryštalický lom

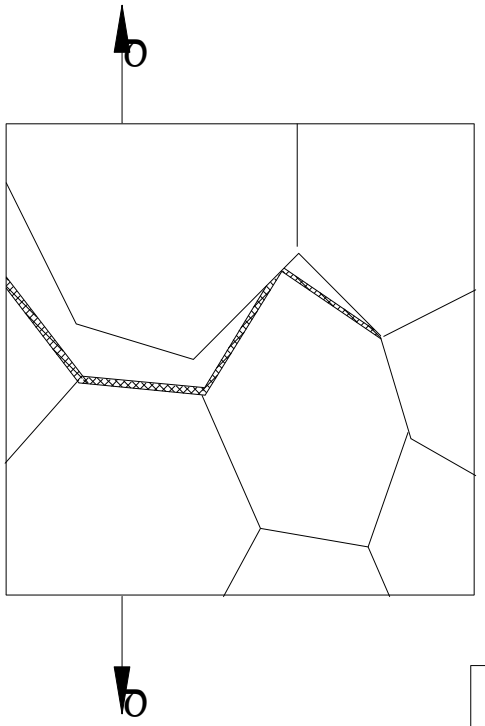
- ⇨ prebieha po hraniciach zŕn
- ⇨ nízka spotreba energie

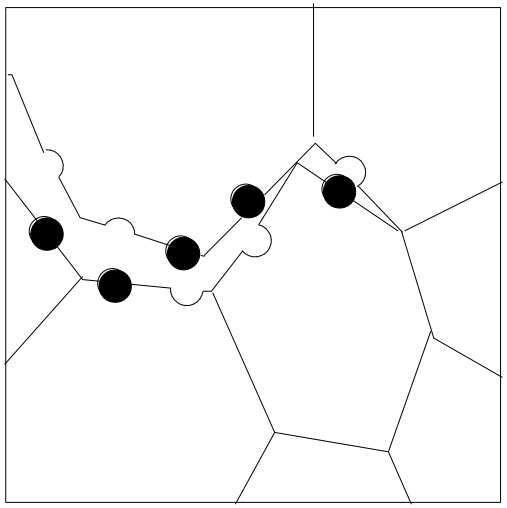
Príčina:

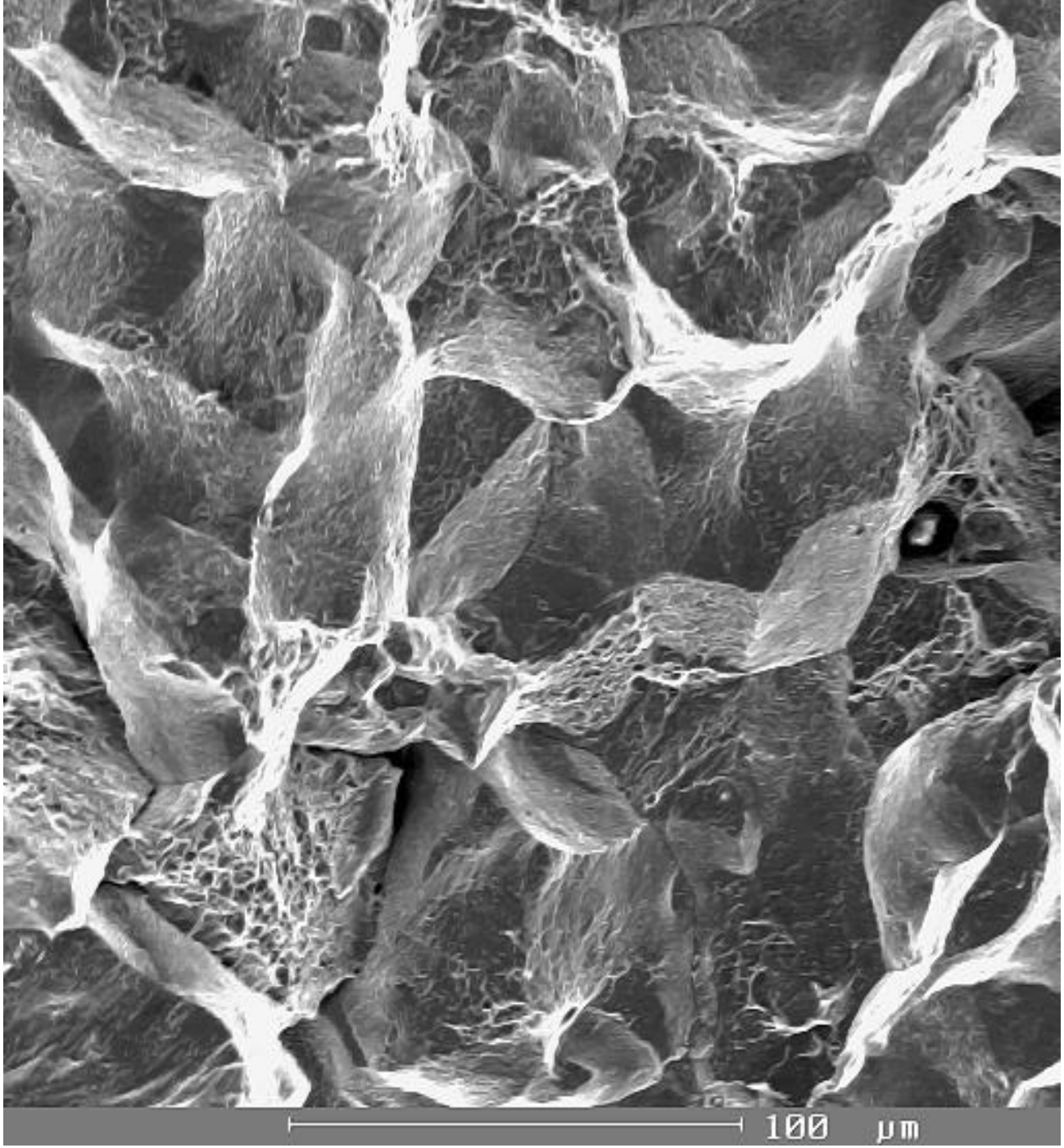
- ⇨ krehká, nekohorentná fáza (fázy) na hranici zŕn

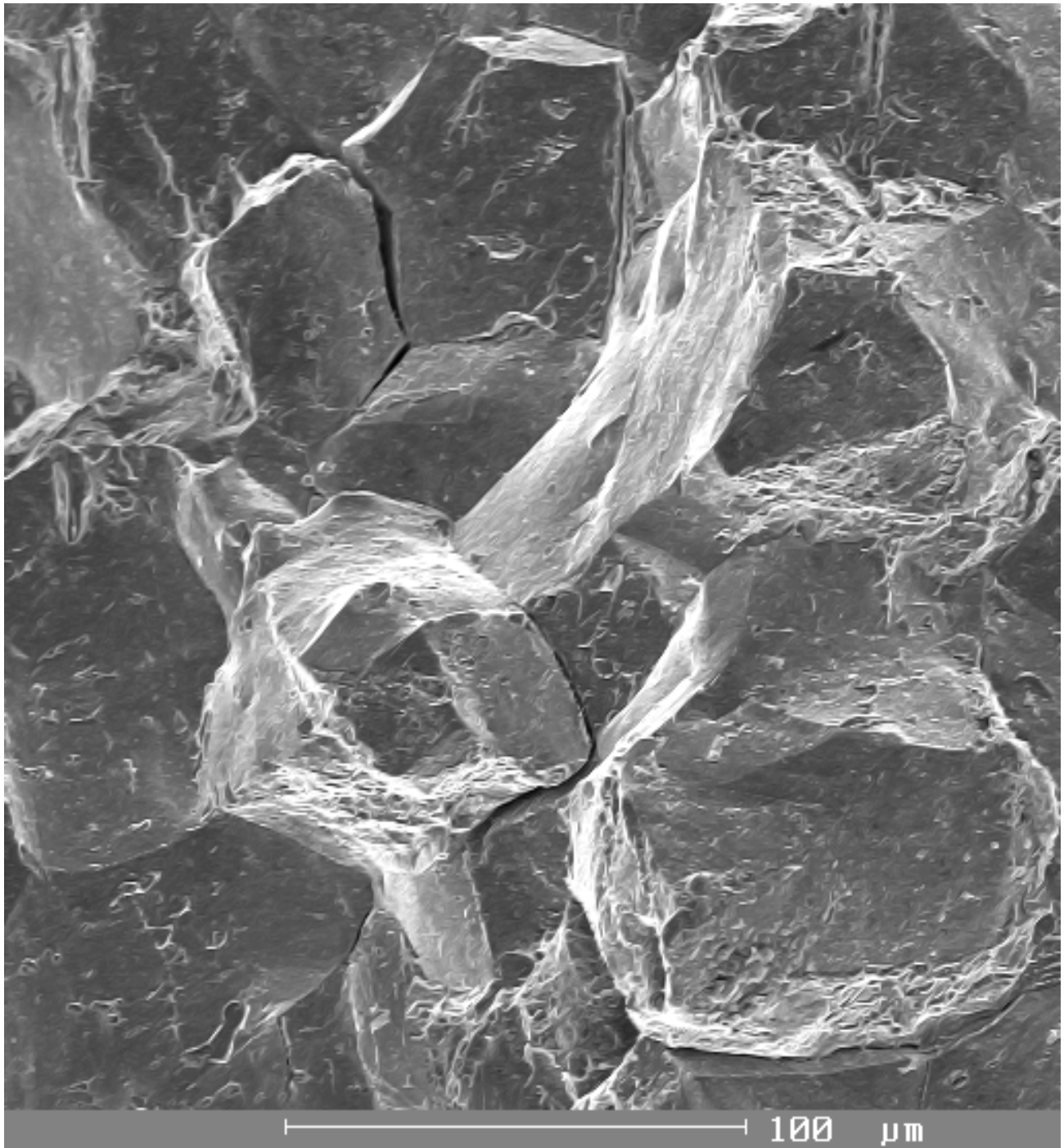
Lom:

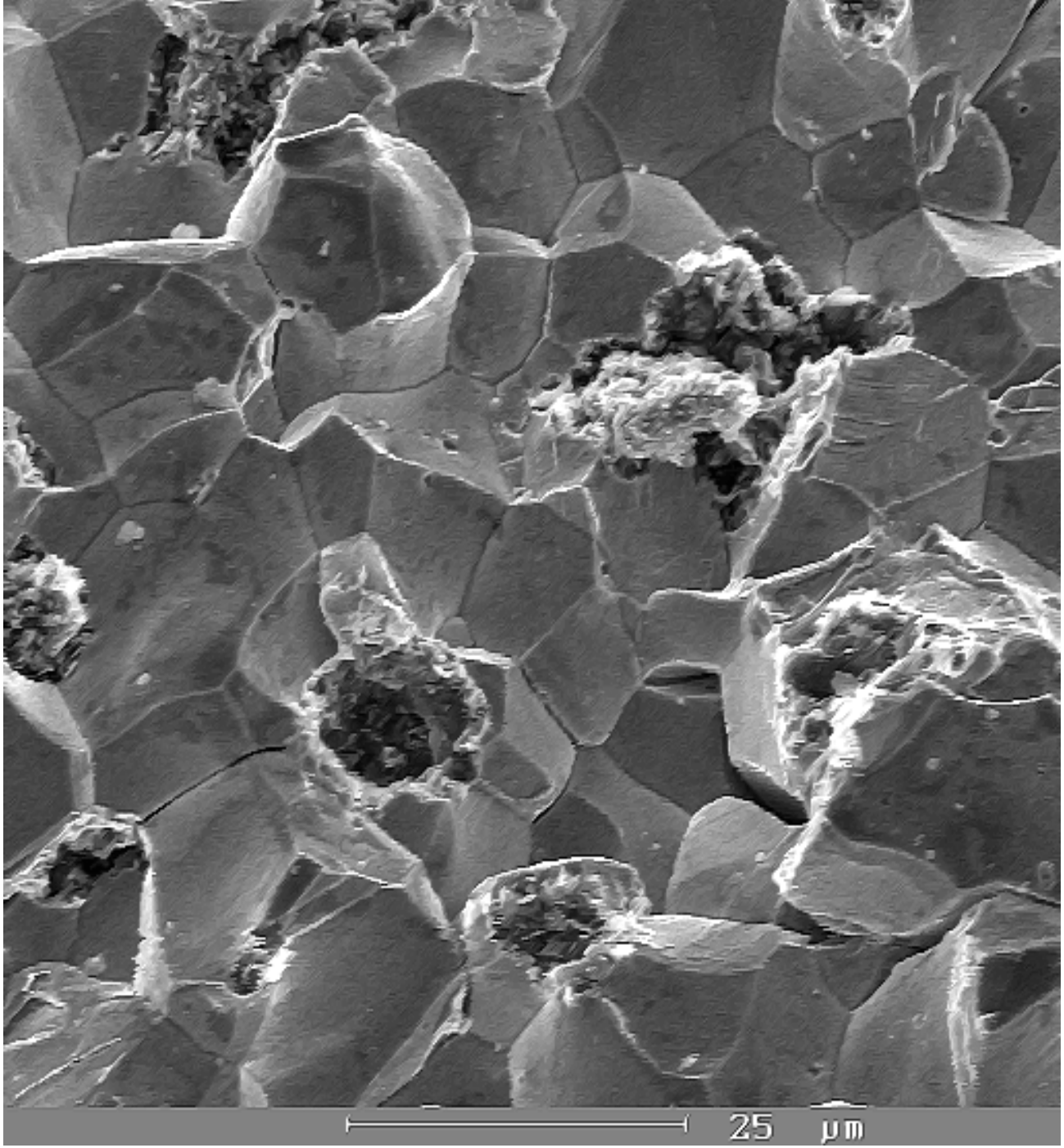
- ⇨ hladký, s plytkou morfológiou, alebo obsahuje zachytené častice vylúčenej fázy





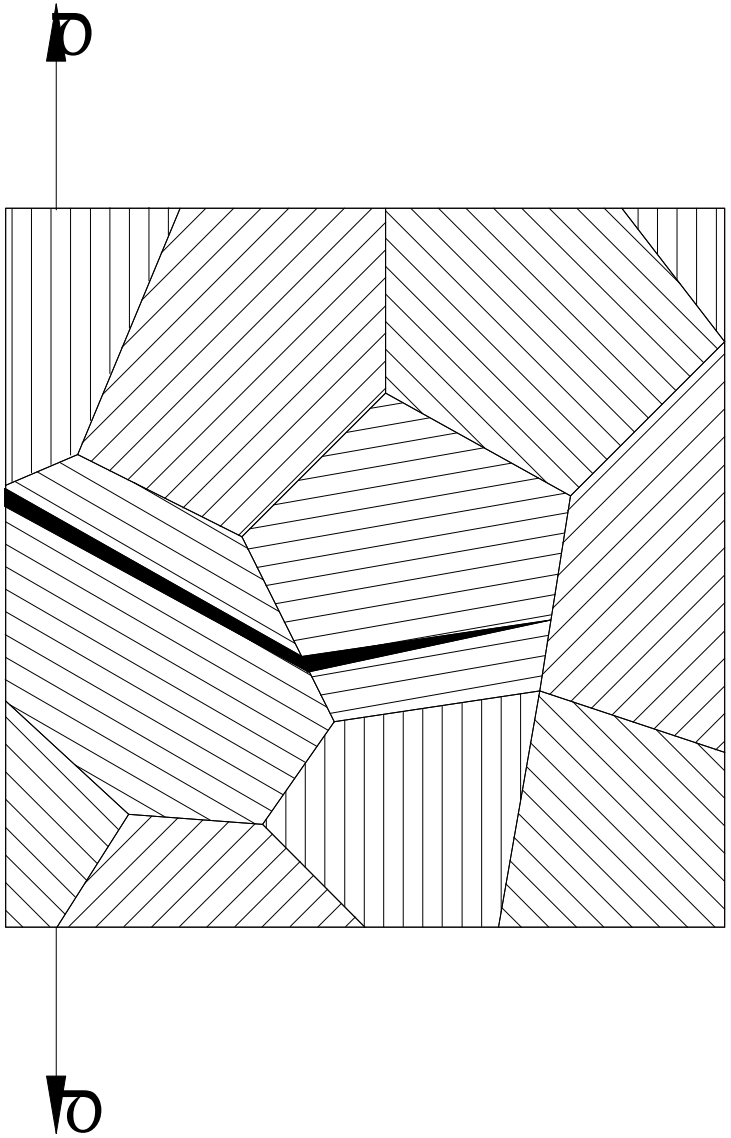

100 µm


100 µm


25 μm

Transkryštalický lom

- ⇨ prebieha po kryštalografických rovinách jednotlivých zŕn
- ⇨ spotreba energie zodpovedá porušeniu medzičasticových väzieb

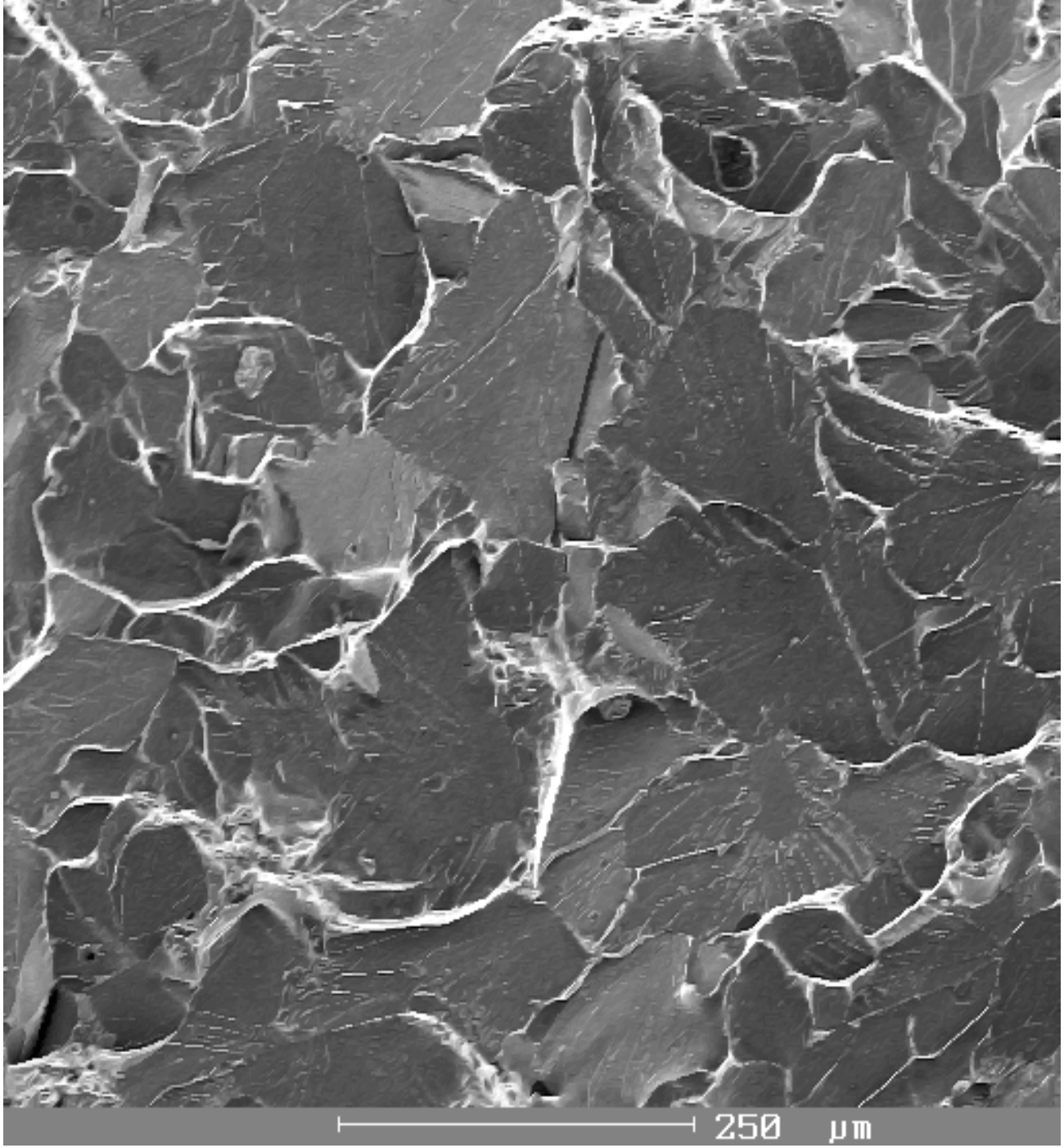


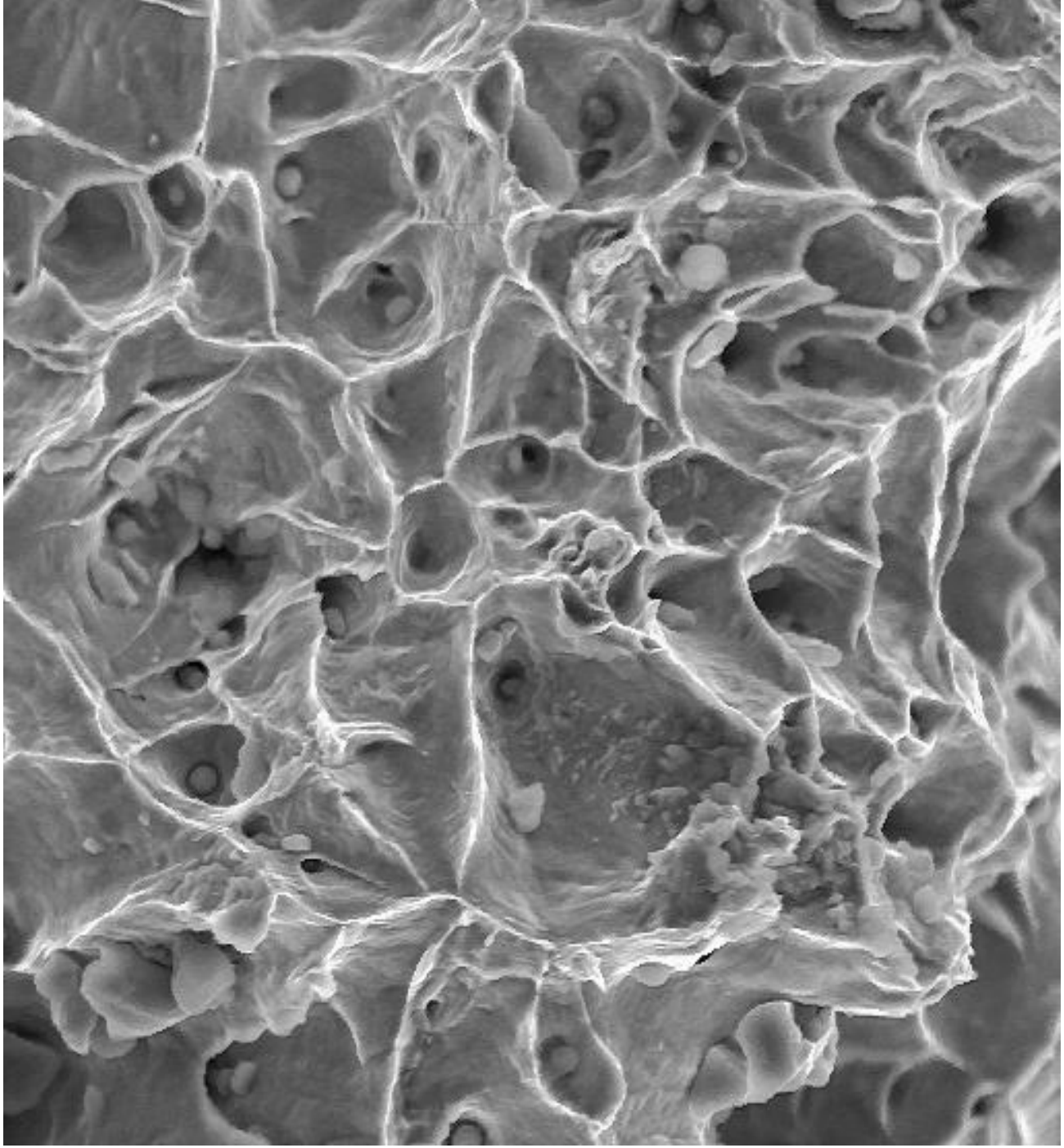
Príčina:

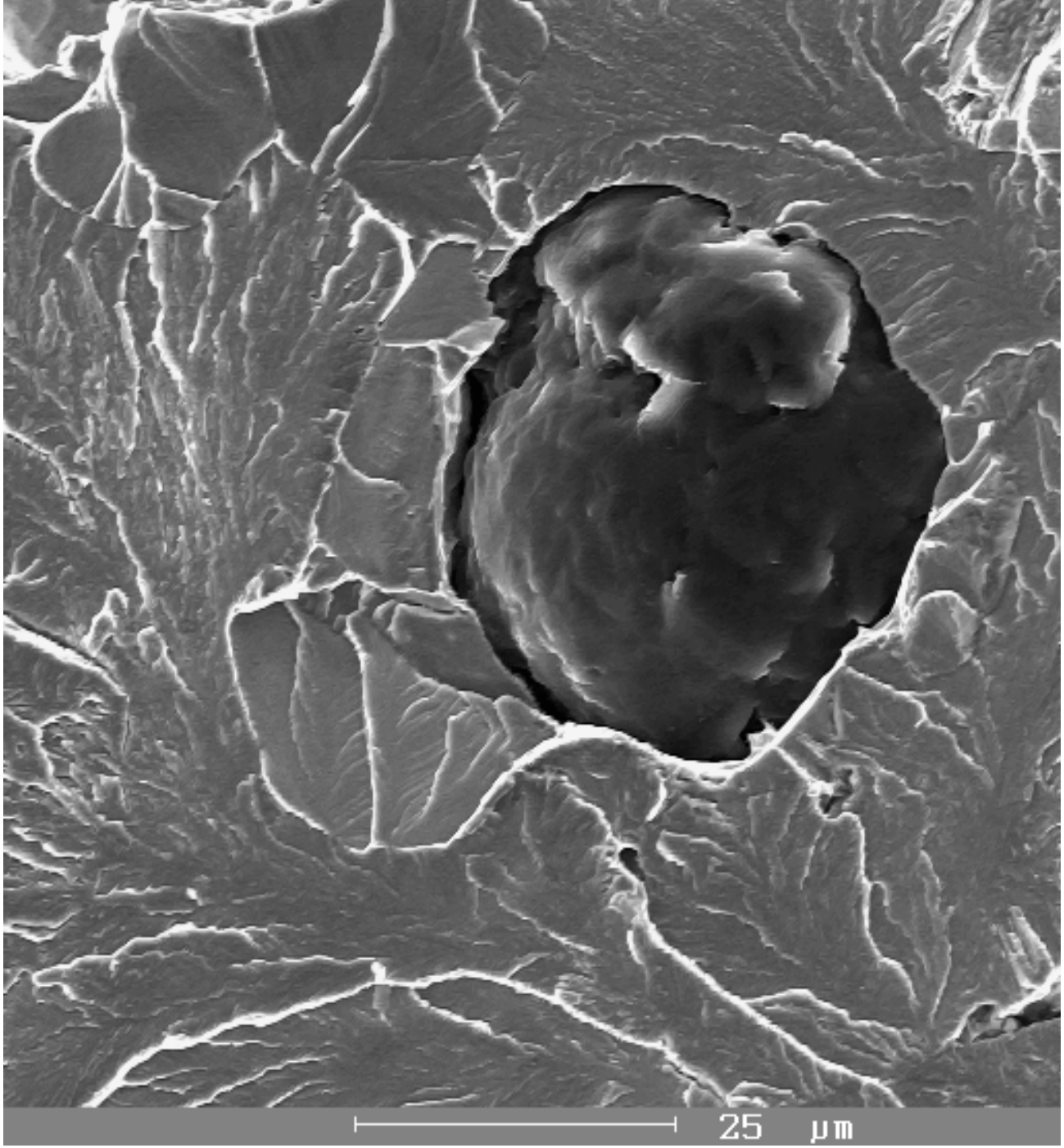
- ⇨ energia napätia je väčšia ako energia väzby v danej kryštalografickej rovine

Lom:

- ⇨ vytvára morfológiu podľa typu mechanizmu porušenia


250 µm




25 µm

Zmiešaný lom

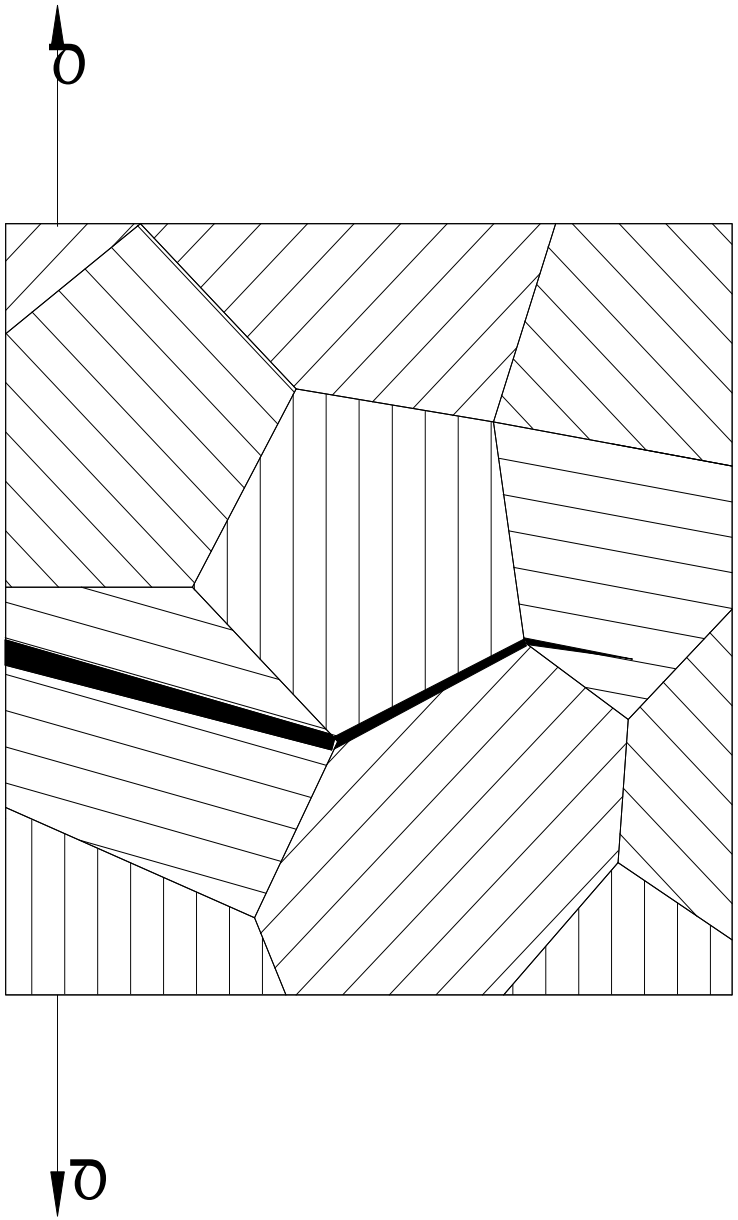
- ⇨ prebieha po hraniciach, aj po kryštalografických rovinách jednotlivých zŕn
- ⇨ spotreba energie riadi cestu šírenia trhliny

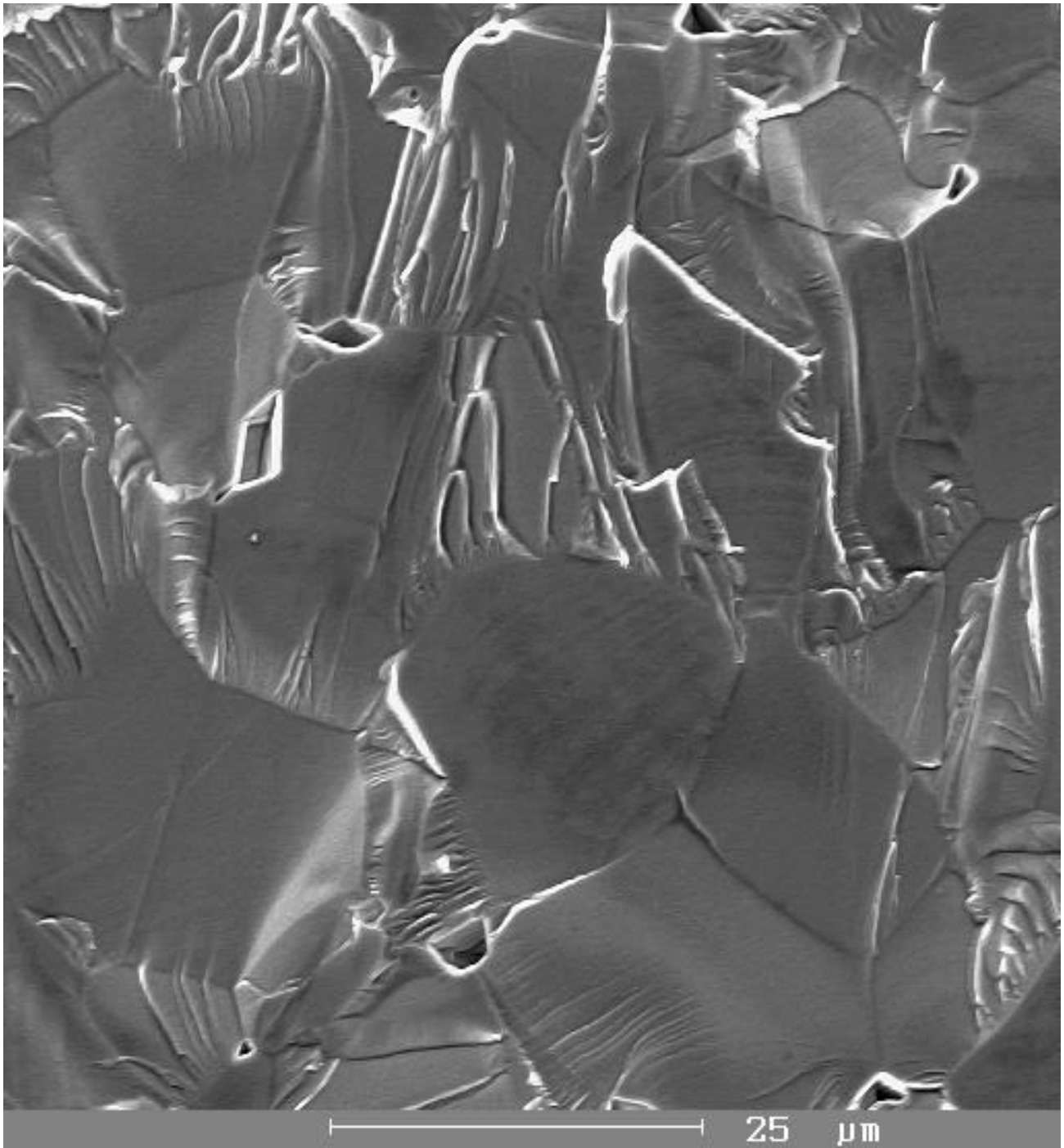
Príčina:

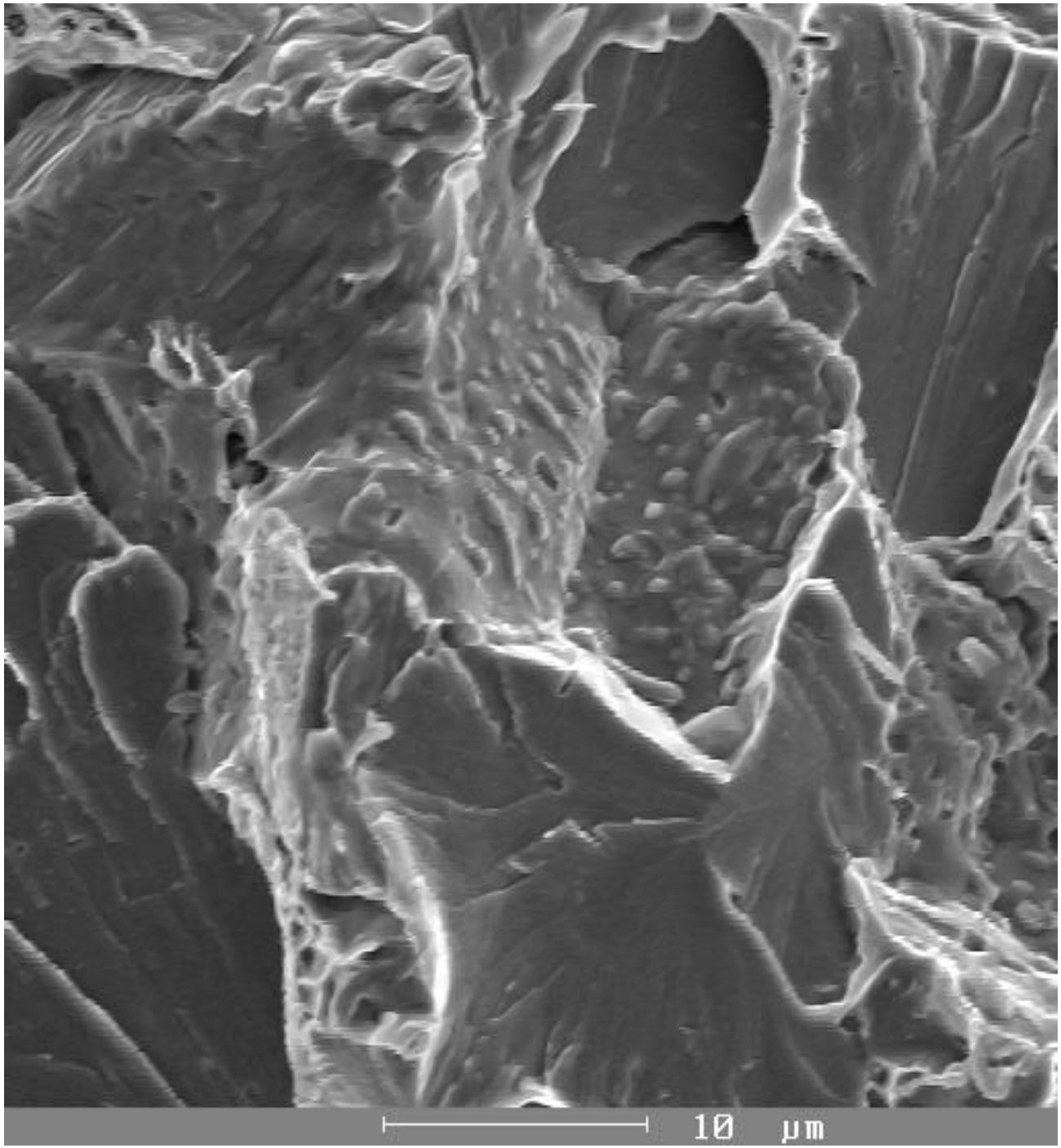
- ⇨ šírenie trhliny sa riadi najnižšou nutnou energiou pre vytvorenie nového (lomového) povrchu

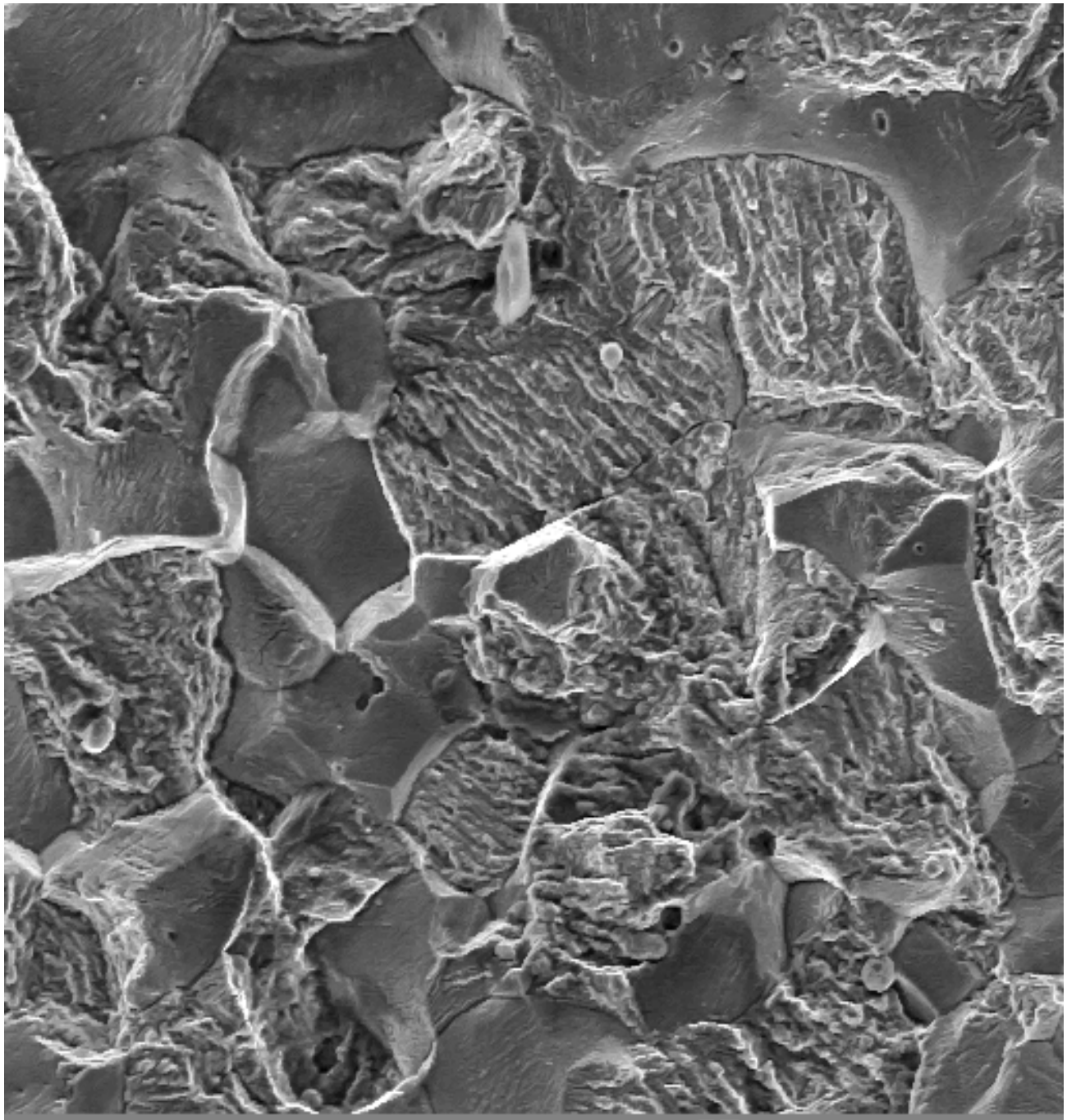
Lom:

- ⇨ vytvára morfológiu podľa typu mechanizmu porušenia

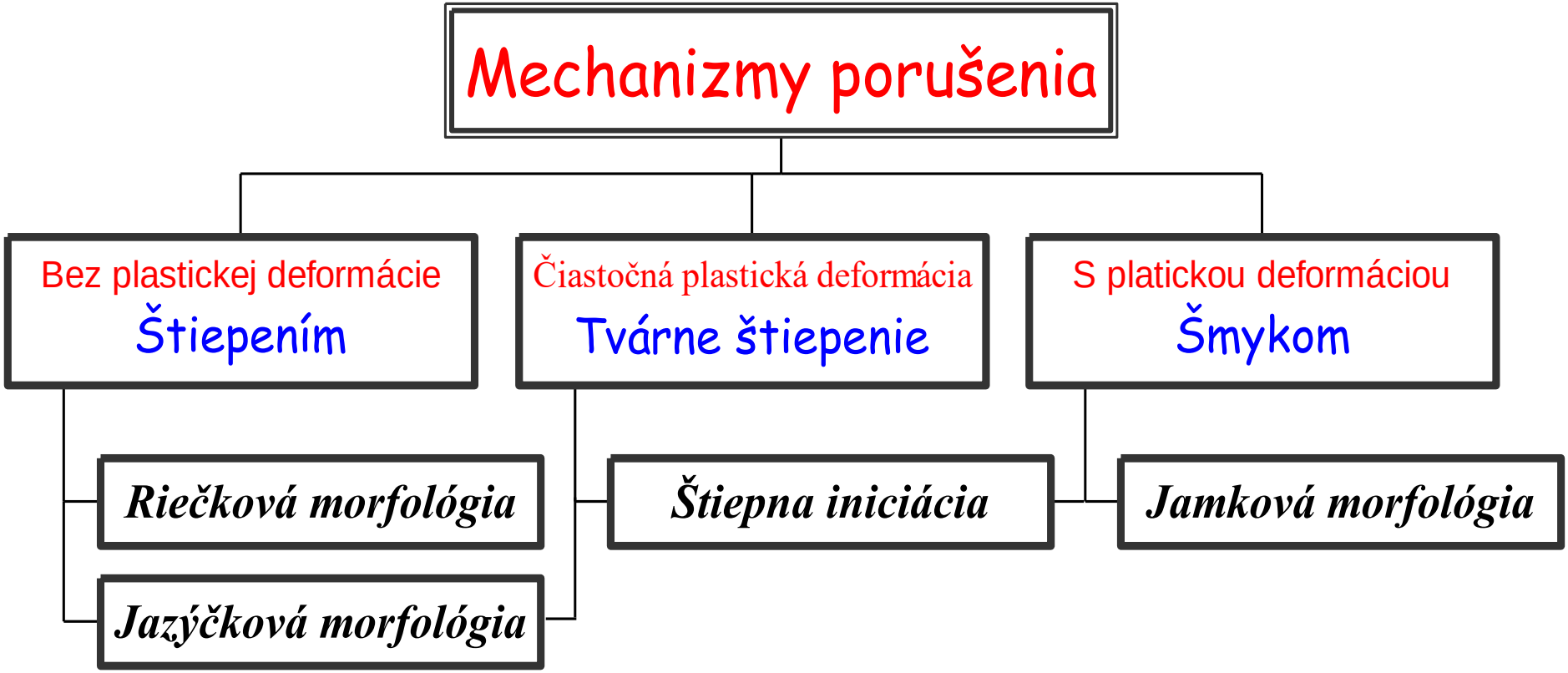



25 µm


10 µm

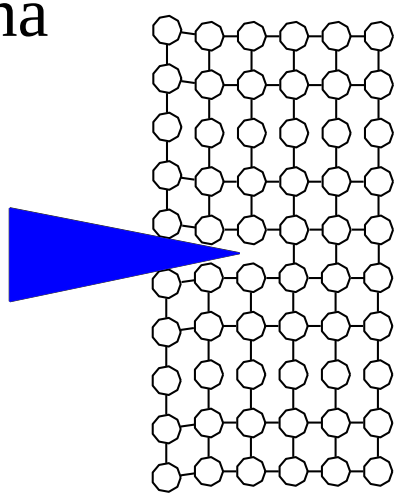

25 μm

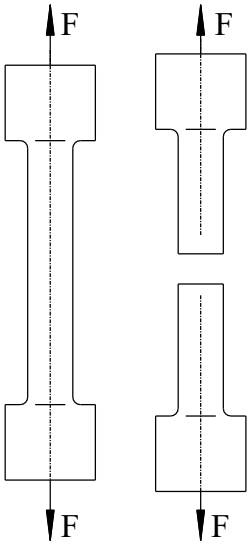
SILOVÉ LOMY

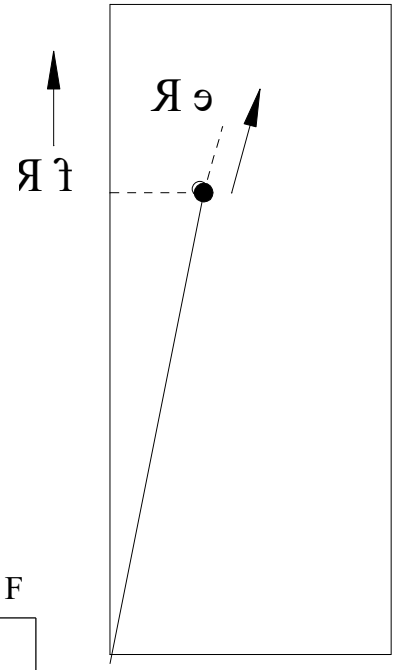

Mechanizmy porušenia
Bez plastickej deformácie
Štiepením
Čiastočná plastická deformácia
Tvárne štiepenie
S platickou deformáciou
Šmykom
Riečková morfológia
Jazýčková morfológia
Štiepna iniciácia
Jamková morfológia

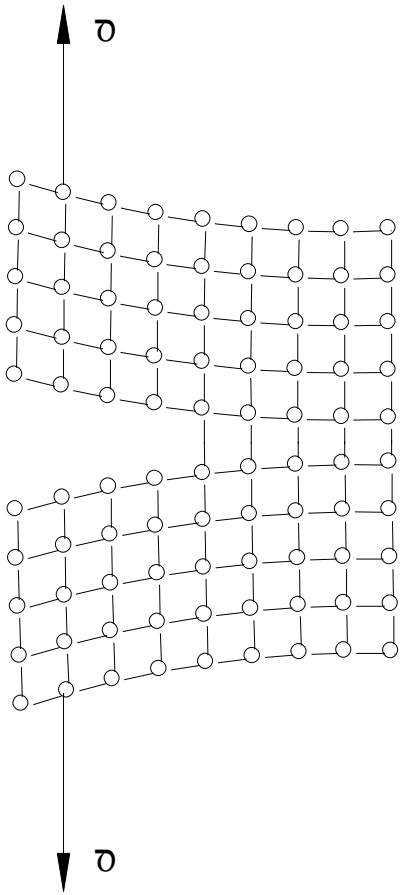
Mechanizmus porušenia štiepením

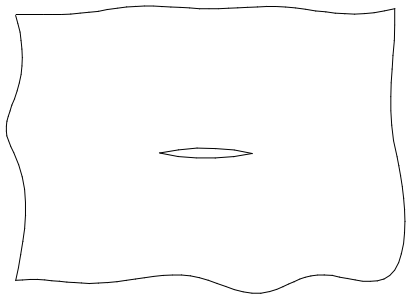
- čelo trhliny môže postupovať po niekoľkých rovnobežných rovinách
- stupne sa spájajú v smere rozvoja trhliny
- miesto, z ktorého sa riečkové stupne šíria, sú miesta vzniku zárodku štiepnej trhliny
- veľkosť štiepnych faziet zodpovedá veľkosti zrna alebo subzrna



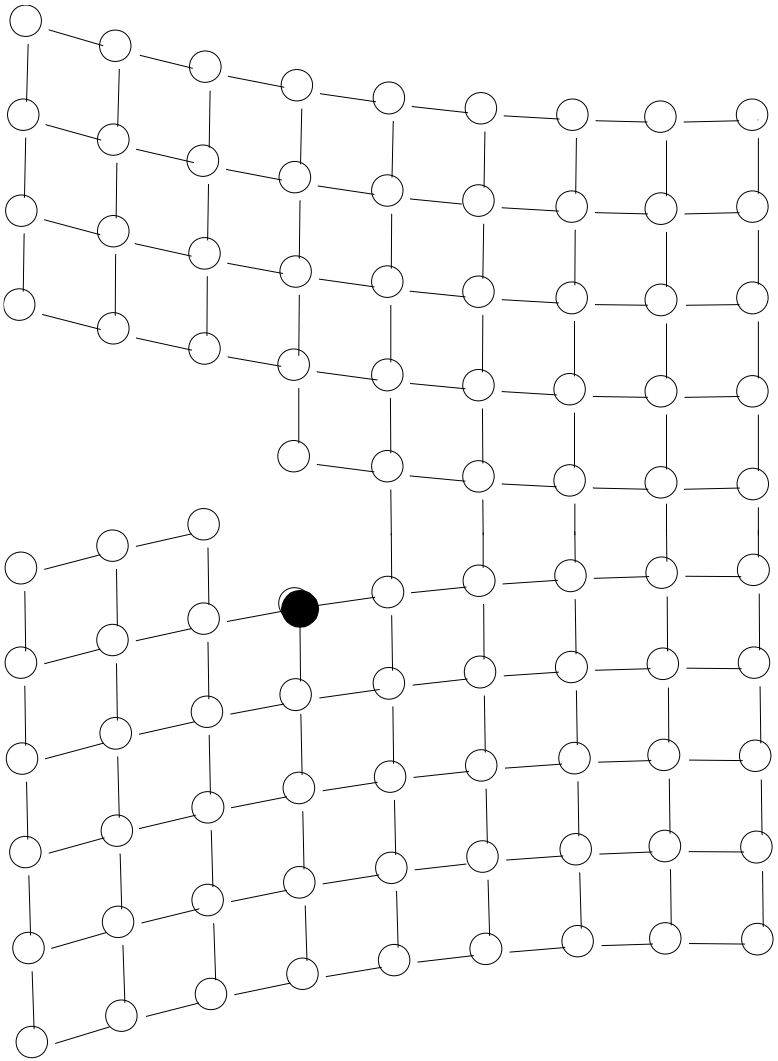


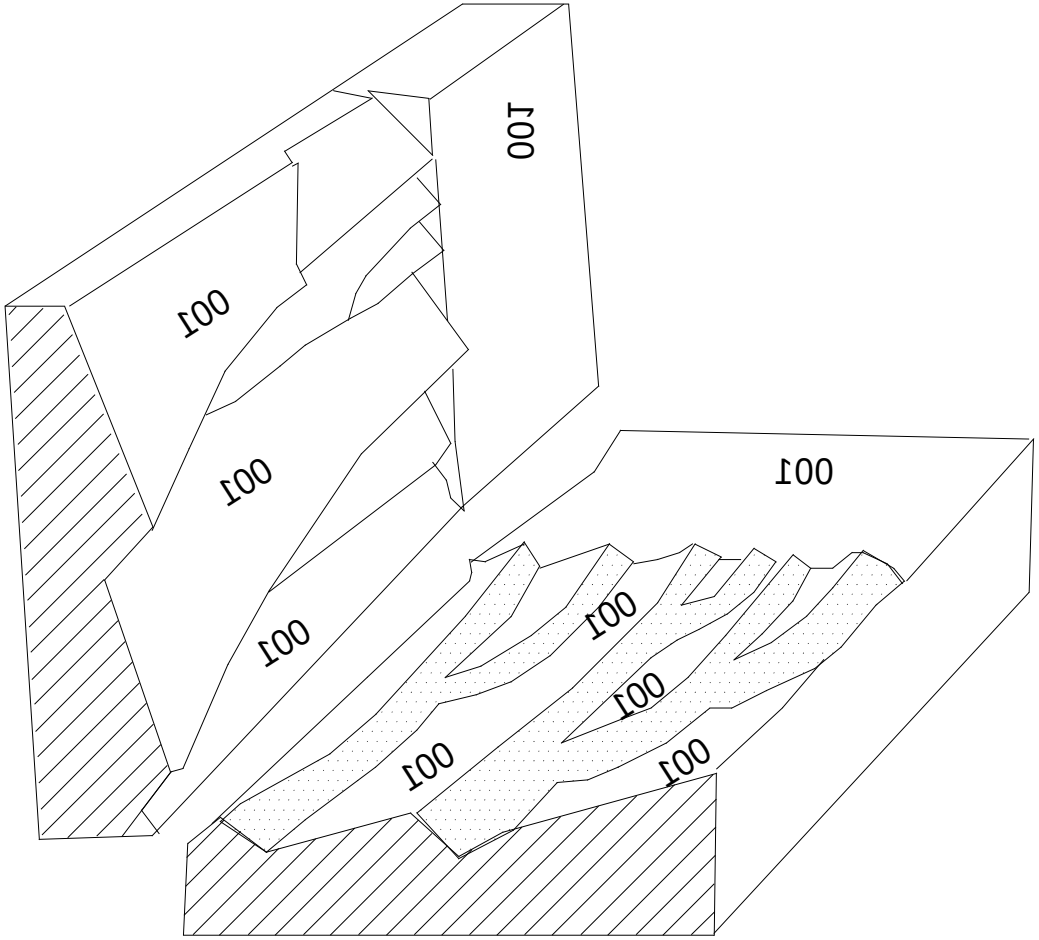


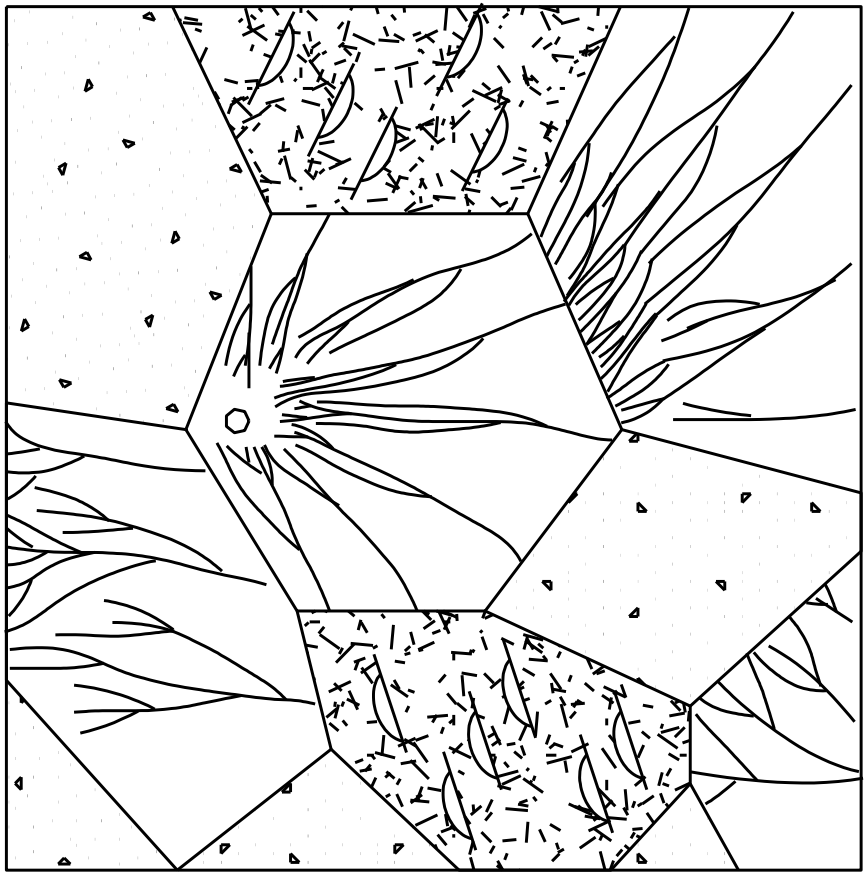


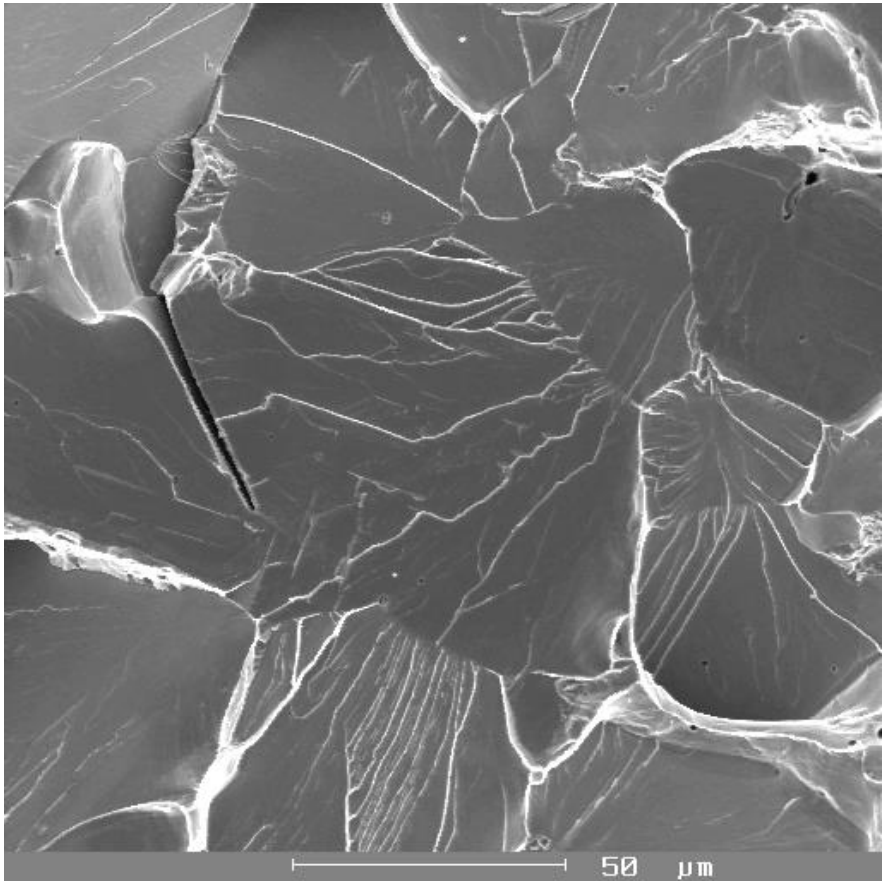


Vznik riečkovej morfológie

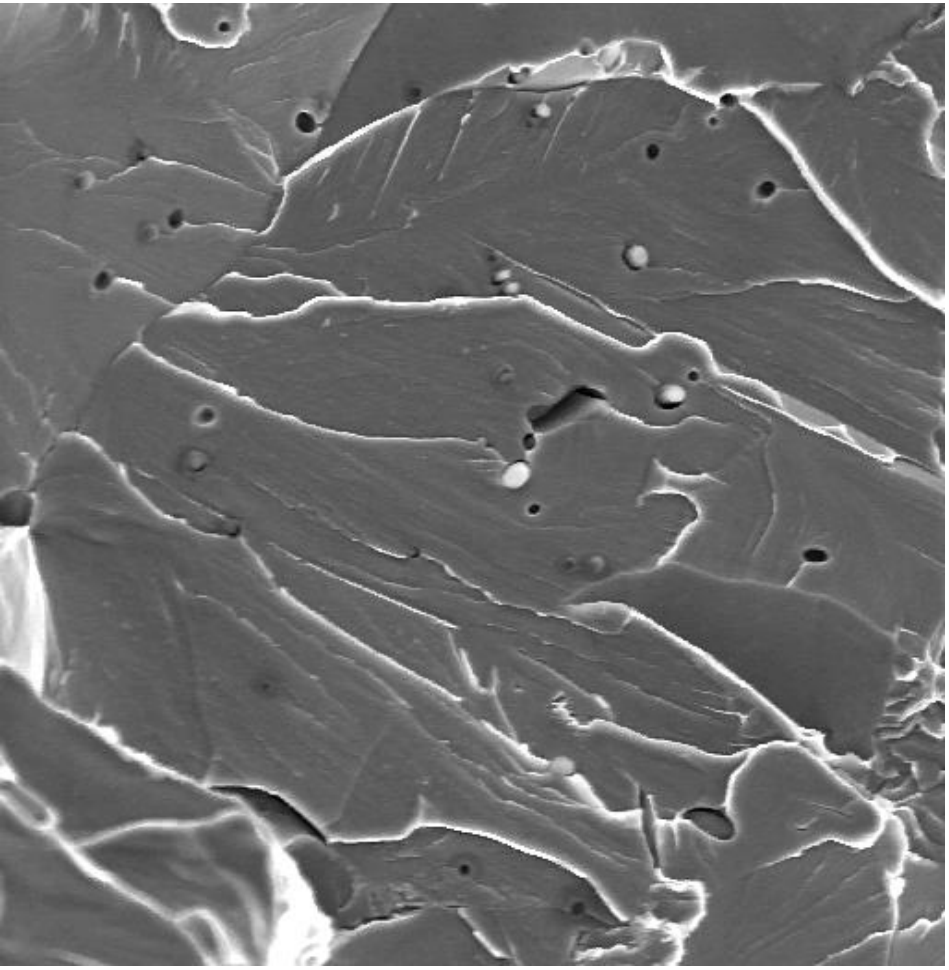


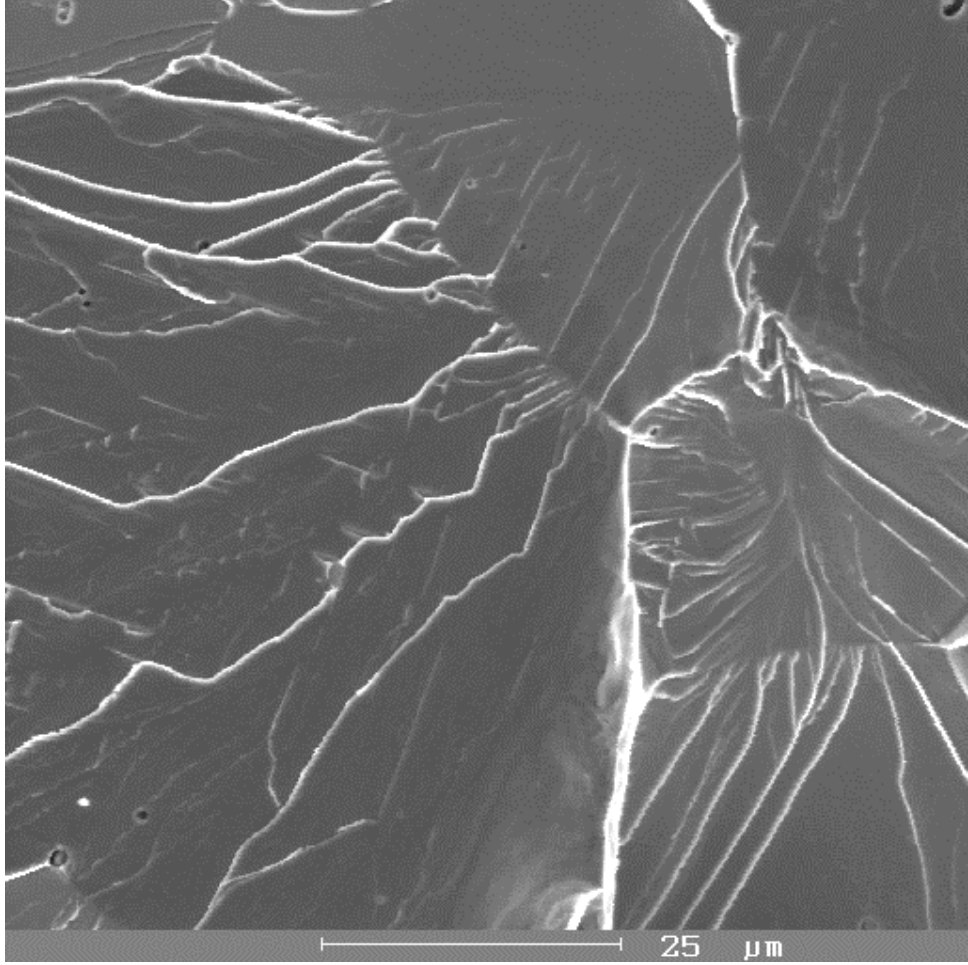






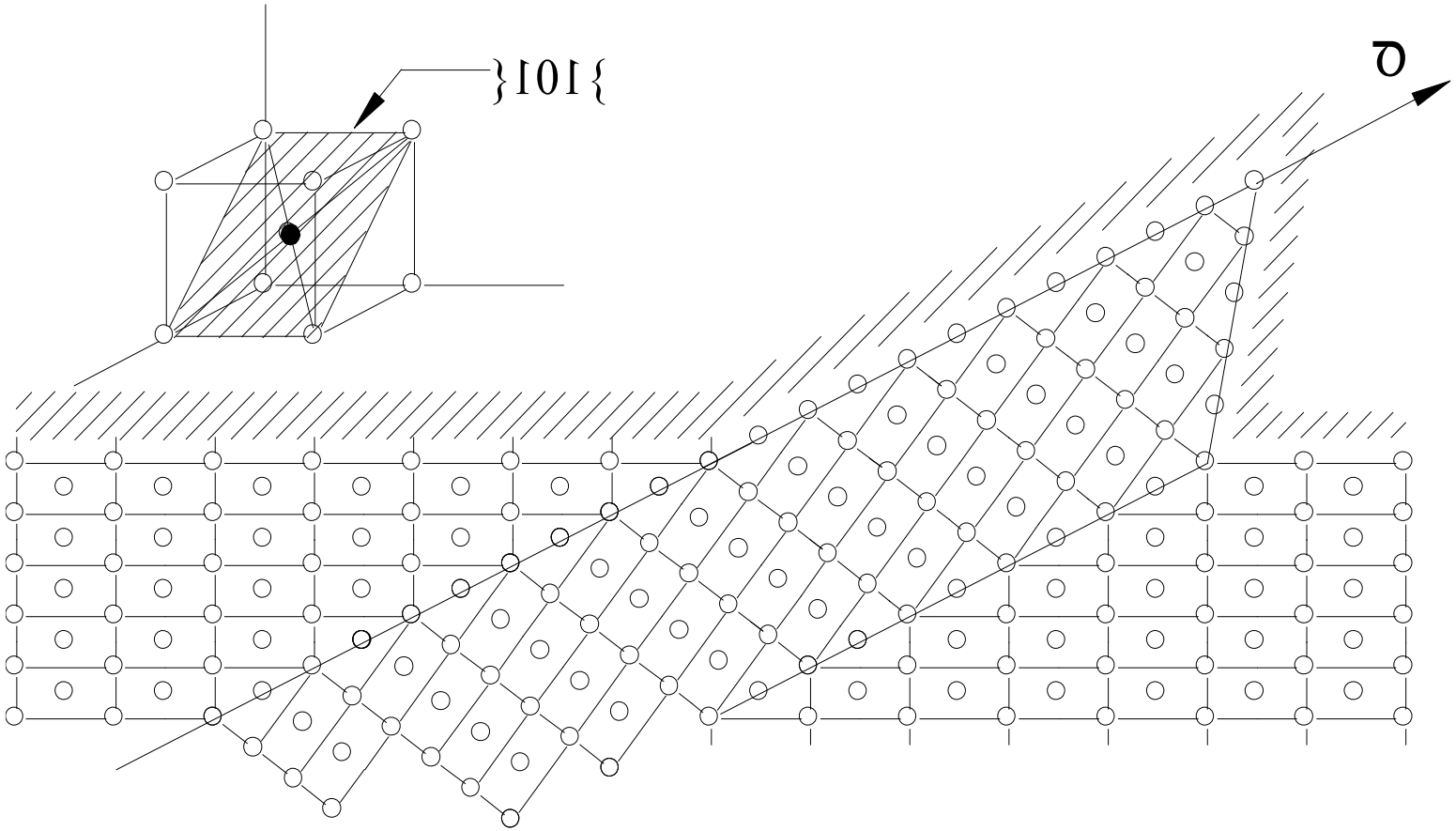
Iniciačné centrá

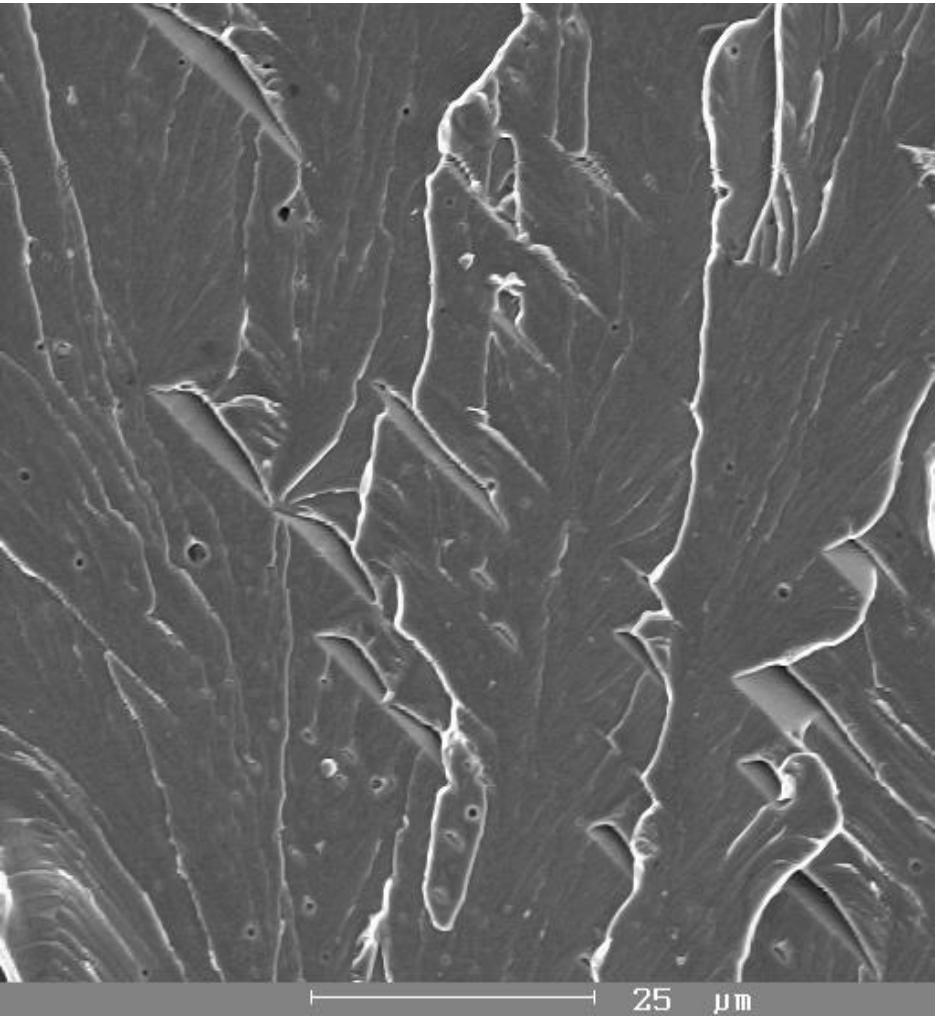



25 µm

Vznik jazýčkovej morfológie

- ⇨ nutná čiastočná plastická deformácia dvojčatením
- ⇨ výskyt rastie s klesajúcou teplotou
- ⇨ klesá s predchádzajúcou plastickou deformáciou

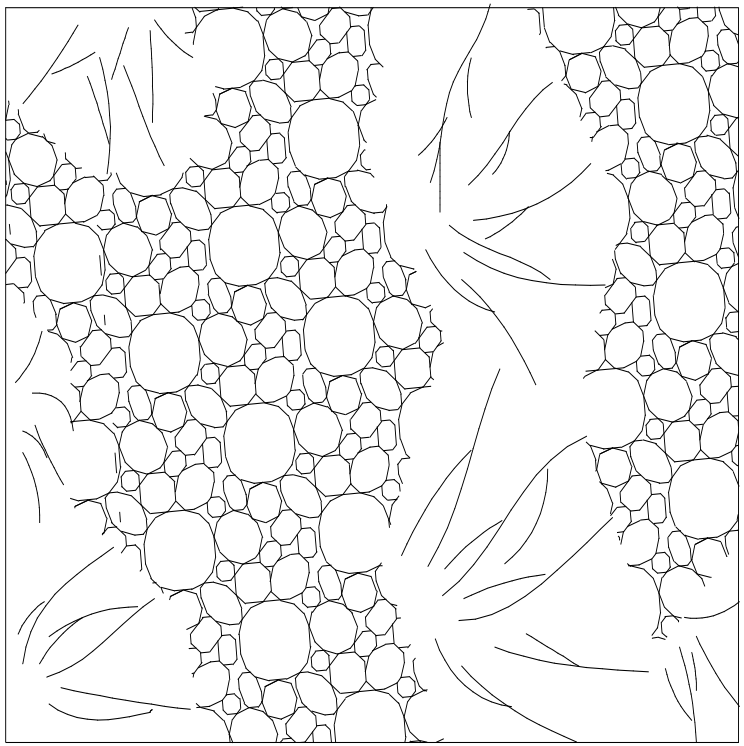


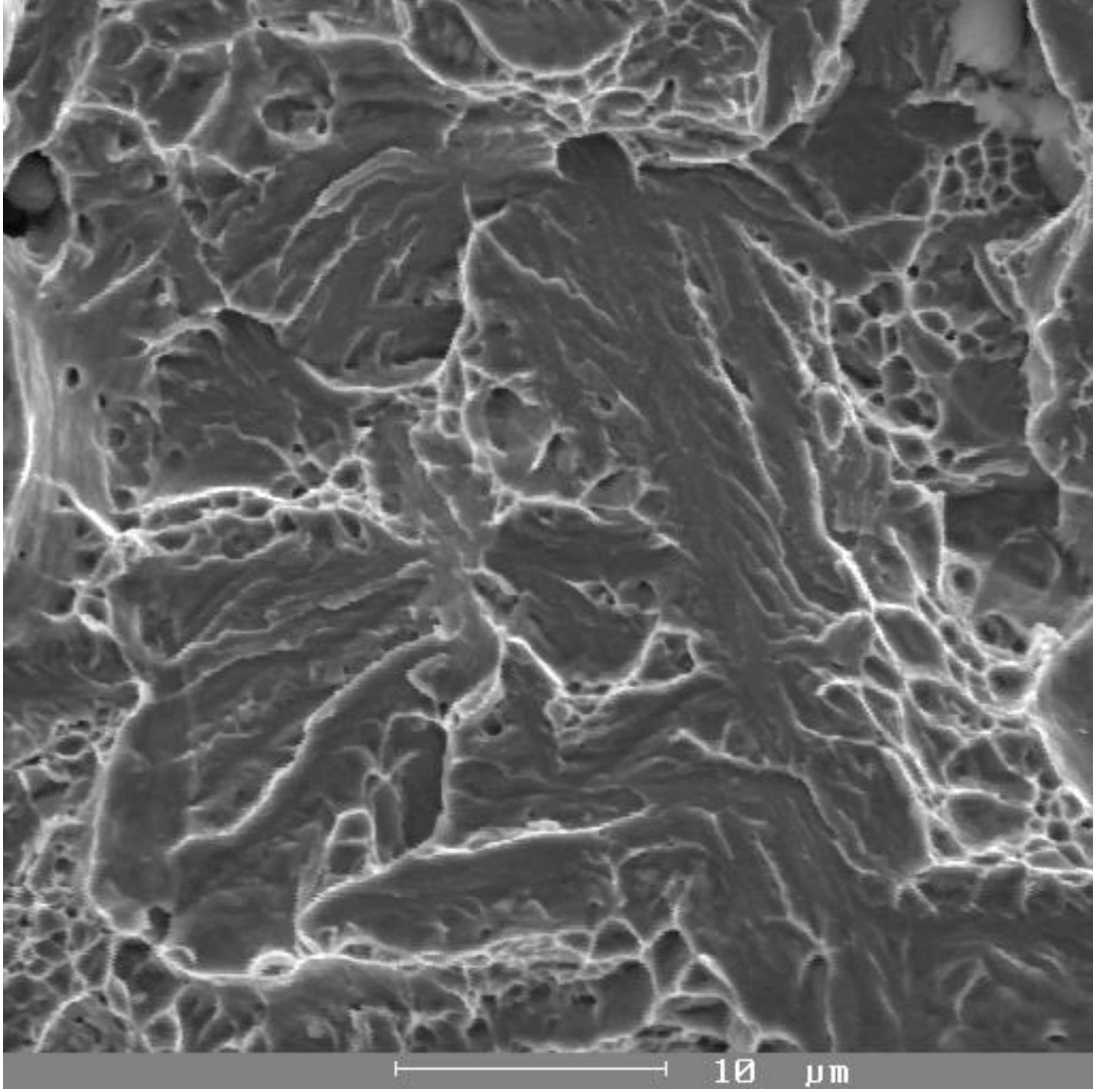

25 µm

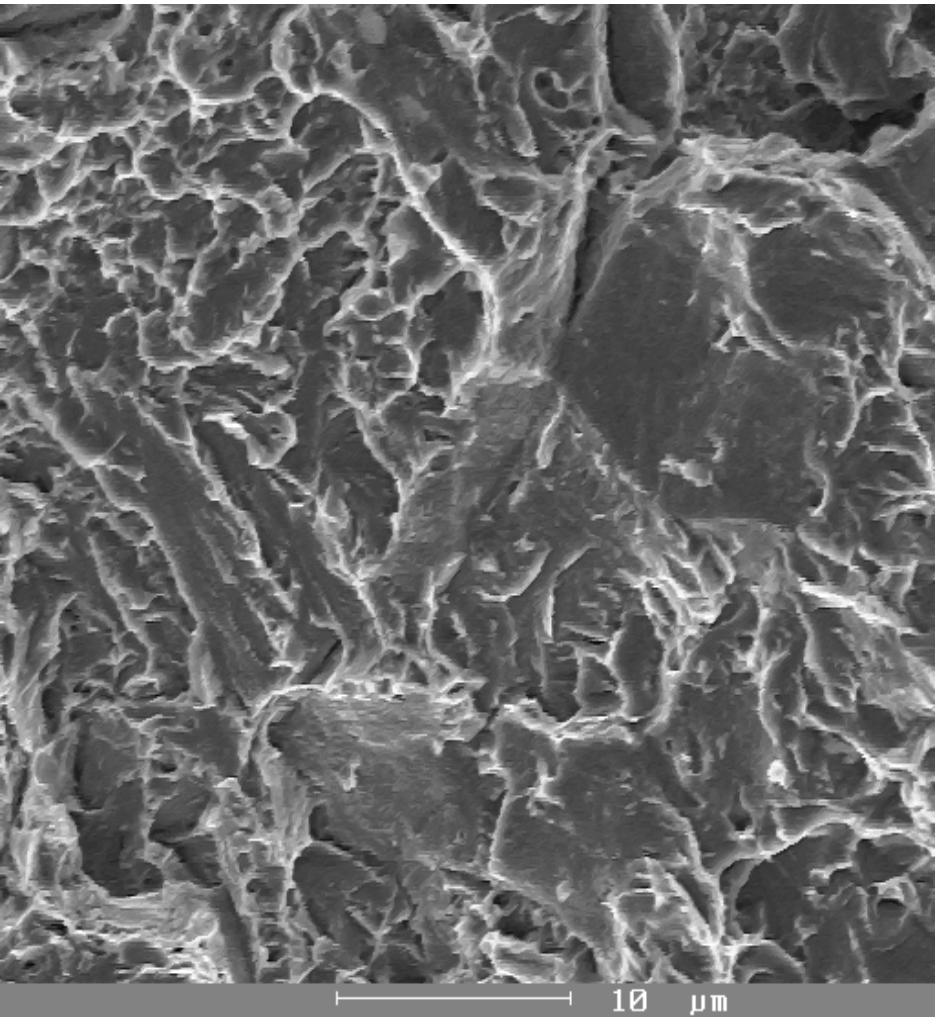
25 µm

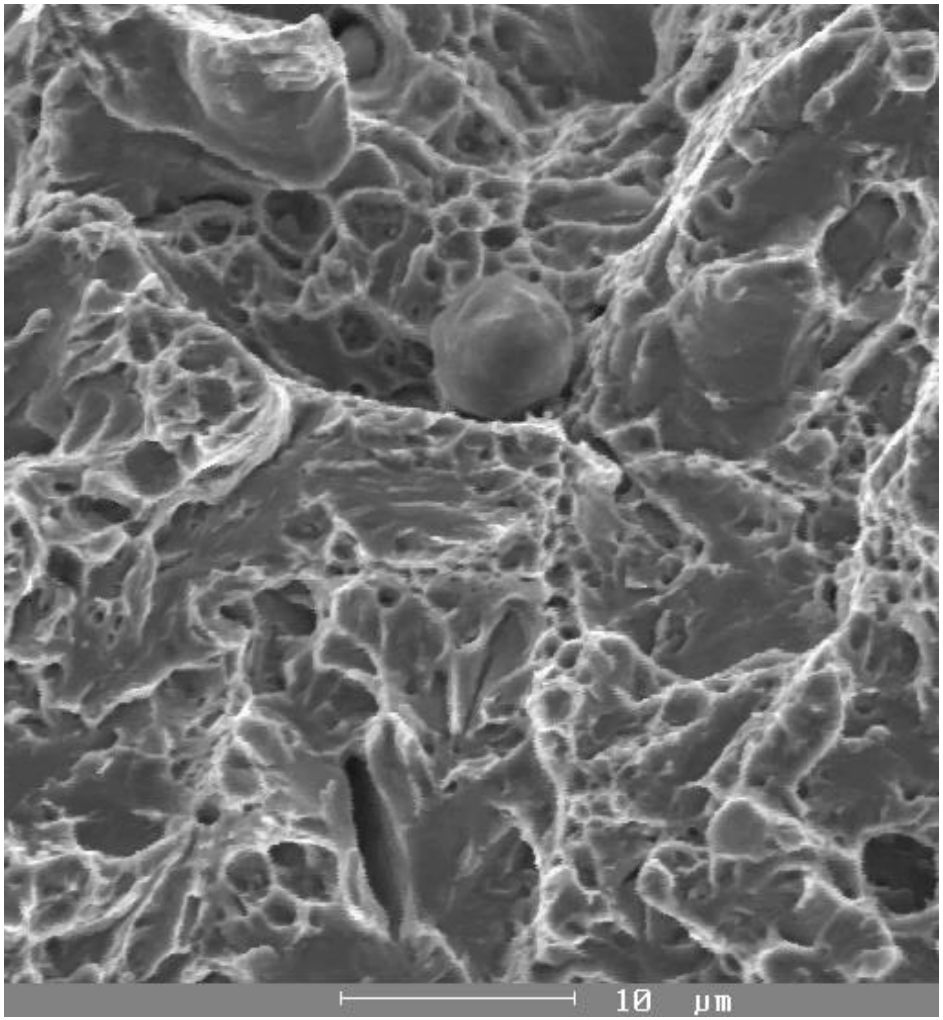
Mechanizmus tvárneho štiepenia - *kvázištiepenie*

- ⇨ tento mechanizmus predstavuje prechod medzi štiepením a tvárnym porušením (tvárny lom so štiepnou iniciáciou)
- ⇨ plastická deformácia sa uplatňuje v priebehu tvorby lomových plôch
- ⇨ vyskytuje sa hlavne pri lomoch vysokopevných ocelí a ocelí s martenzitickou štruktúrou



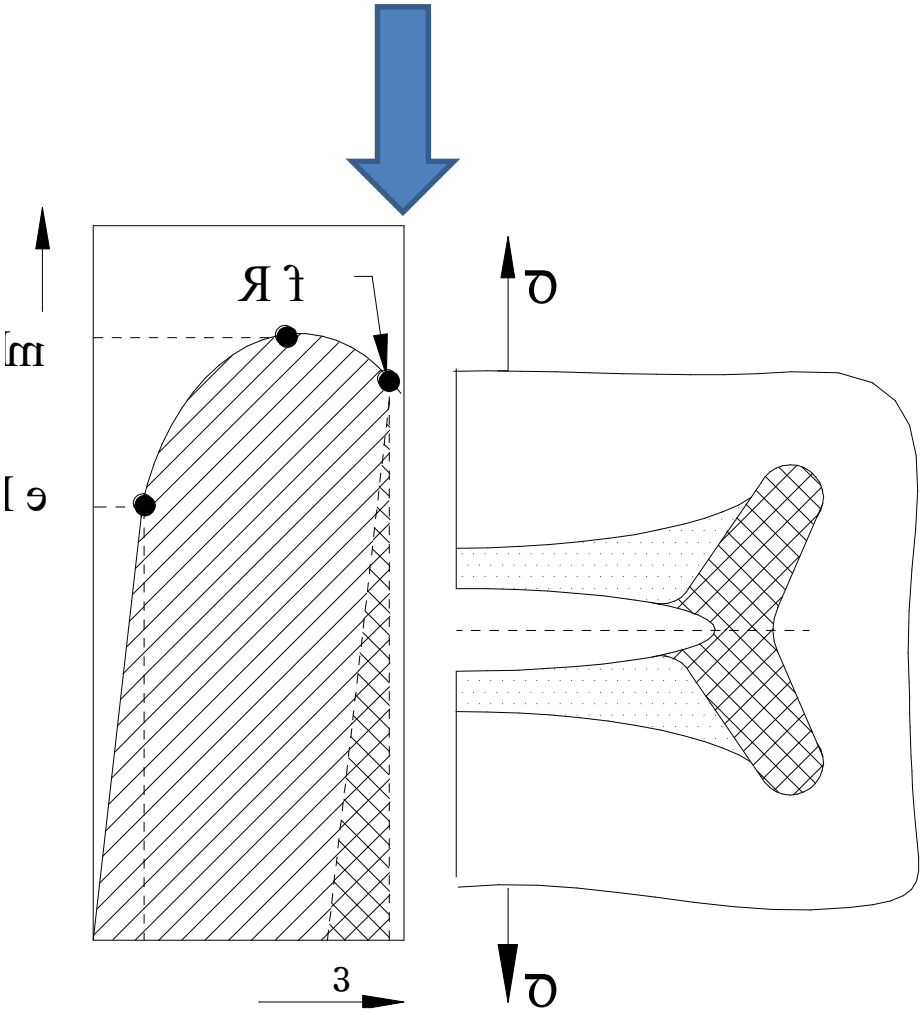

10 µm


10 µm


10 µm

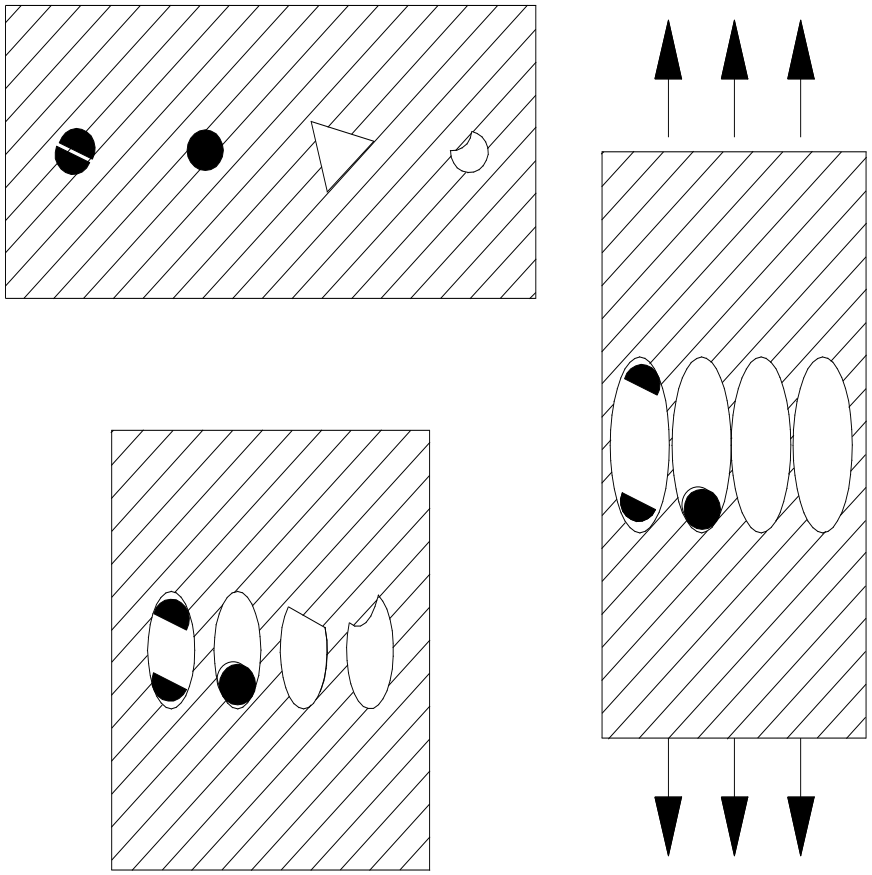
Mechanizmus tvárneho porušenia - *šmykom*

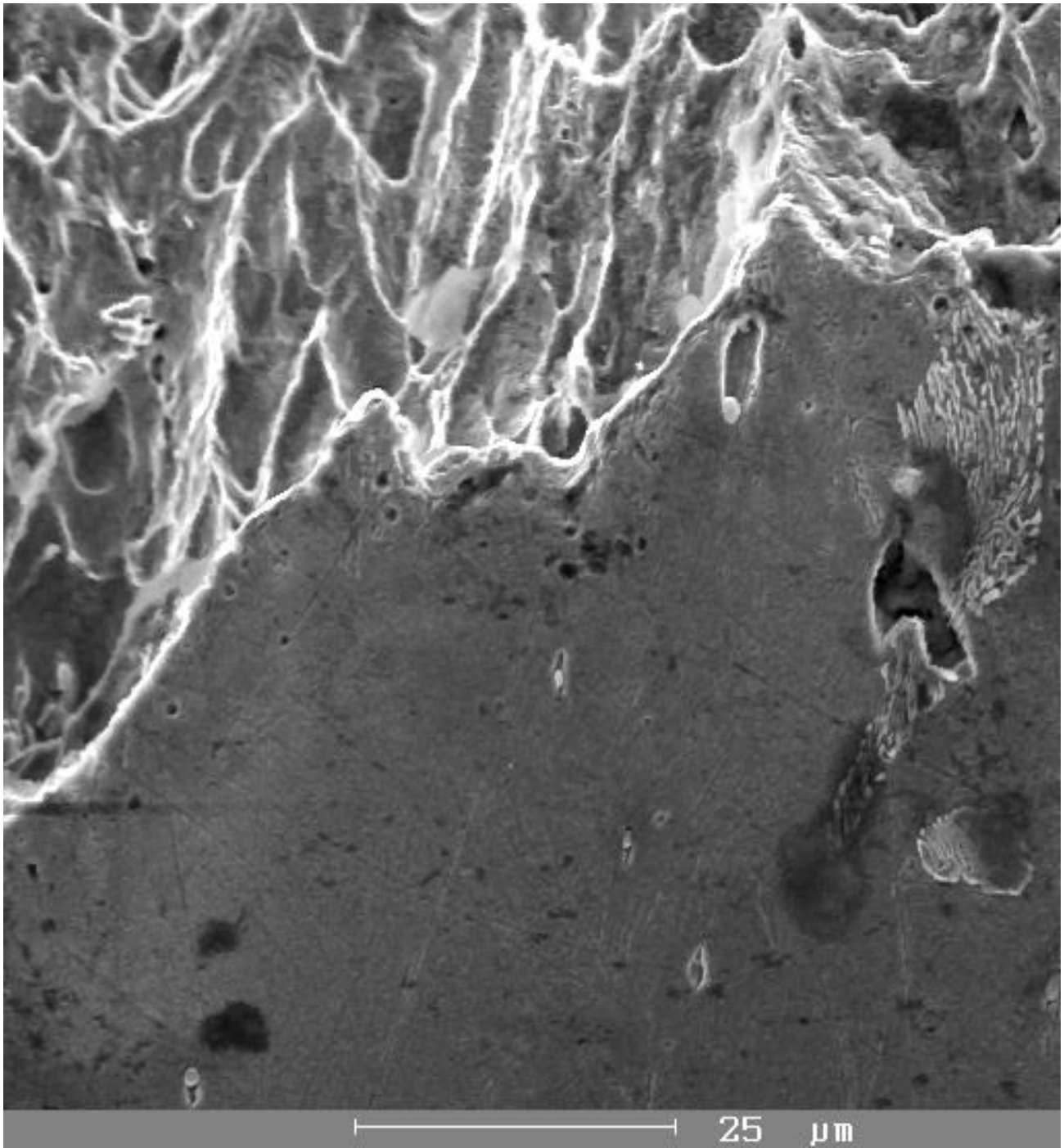
- pred porušením a pri porušovaní prebieha plastická deformácia
- veľkosť deformácie je funkciou druhu, čistoty, štruktúry a deformačného stavu materiálu
- zárodky trhlín sa vytvárajú v mieste výskytu inej fázy (karbidy, sulfidy, precipitáty, vtrúseniny), alebo mikronecelistvosti

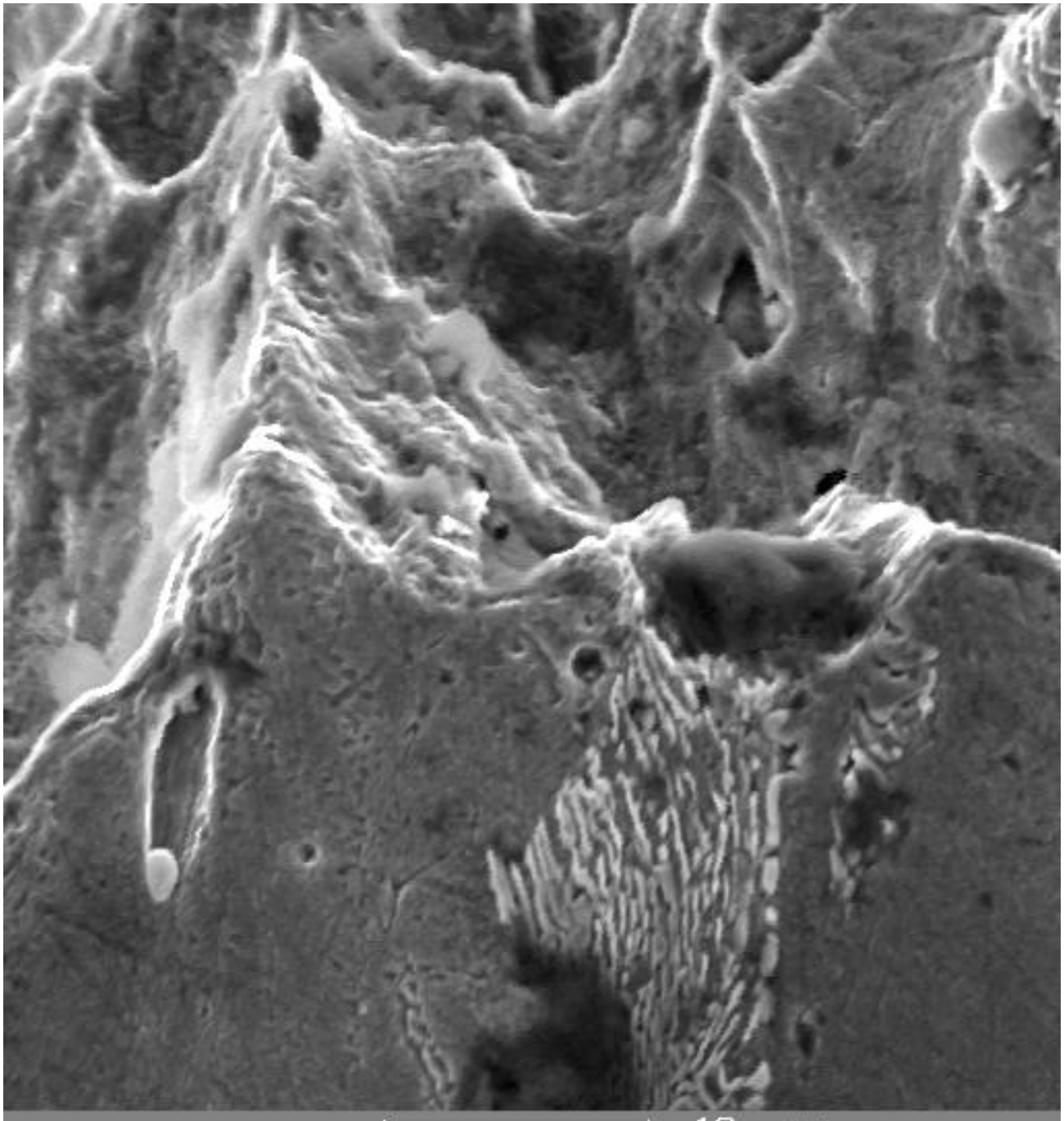


Vznik jamkovej morfológie

- ⇨ pri deformácii telesa zárodky zväčšujú svoj priemer v smere kolmom na smer hlavného ťahového napätia
- ⇨ mostíky medzi dutinami sa vyťahujú a zoslabujú
- ⇨ postupné porušovanie mostíkov predstavuje šírenie trhliny
- ⇨ počas plastickej deformácie nastáva dekohézia danej fázy od matrice



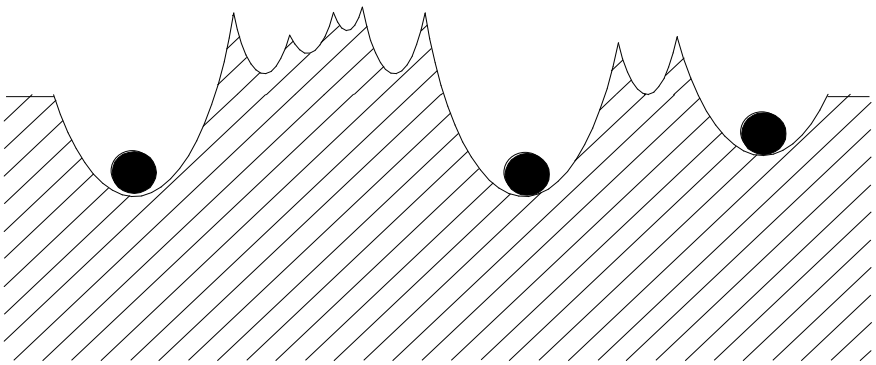

25 µm

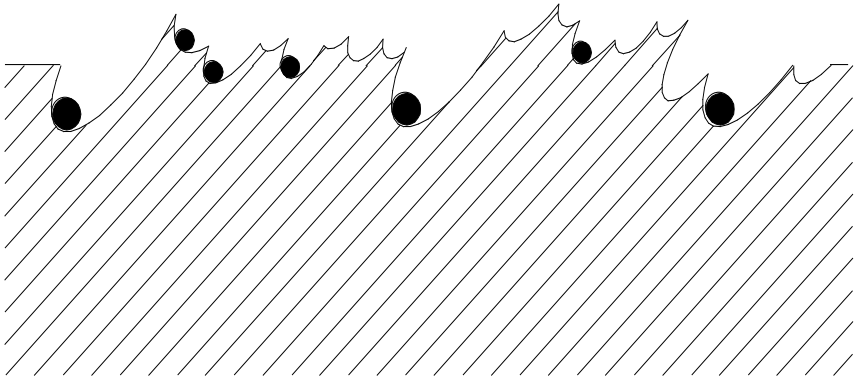

10 µm

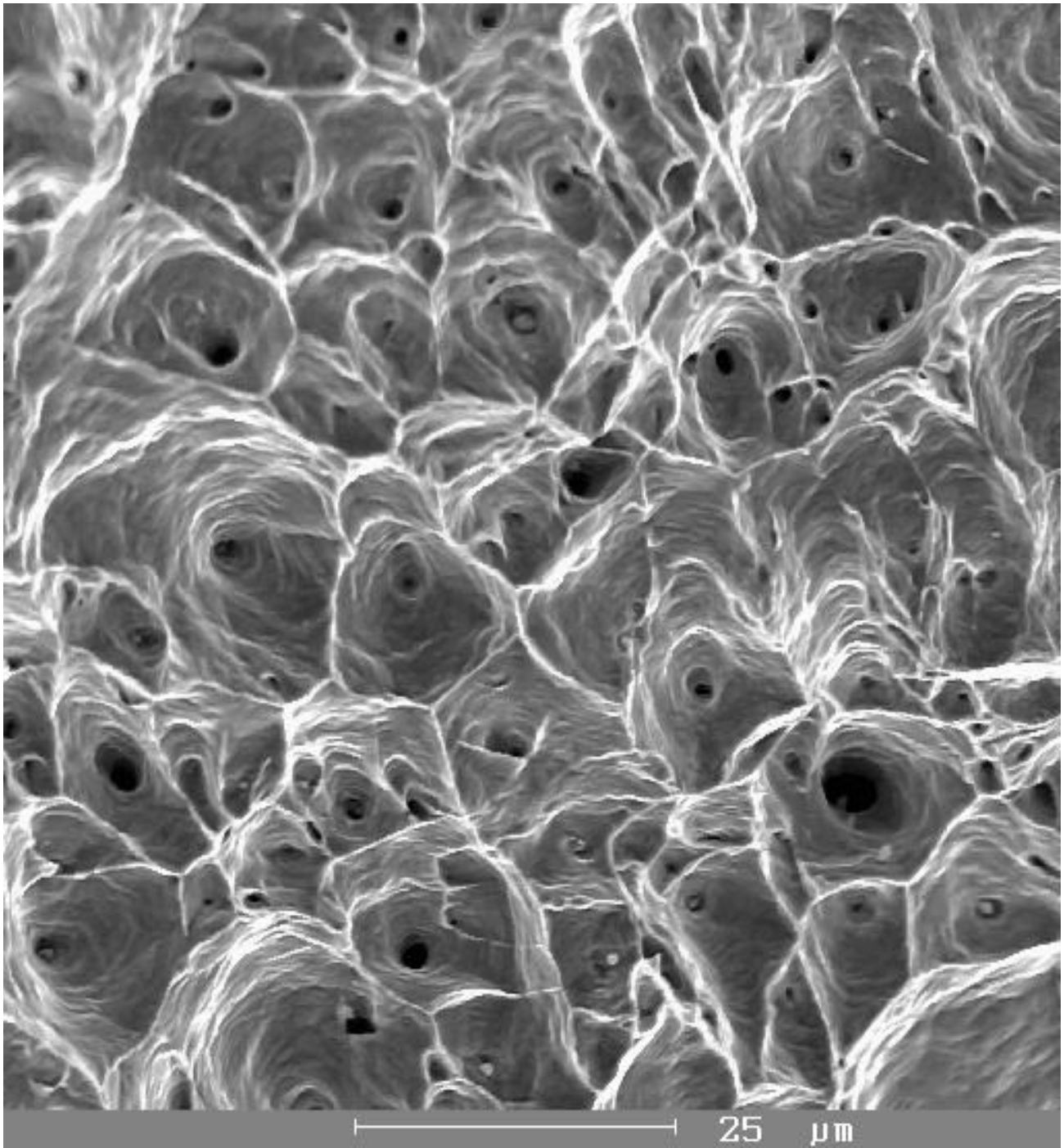
Tvar a veľkosť jamiek

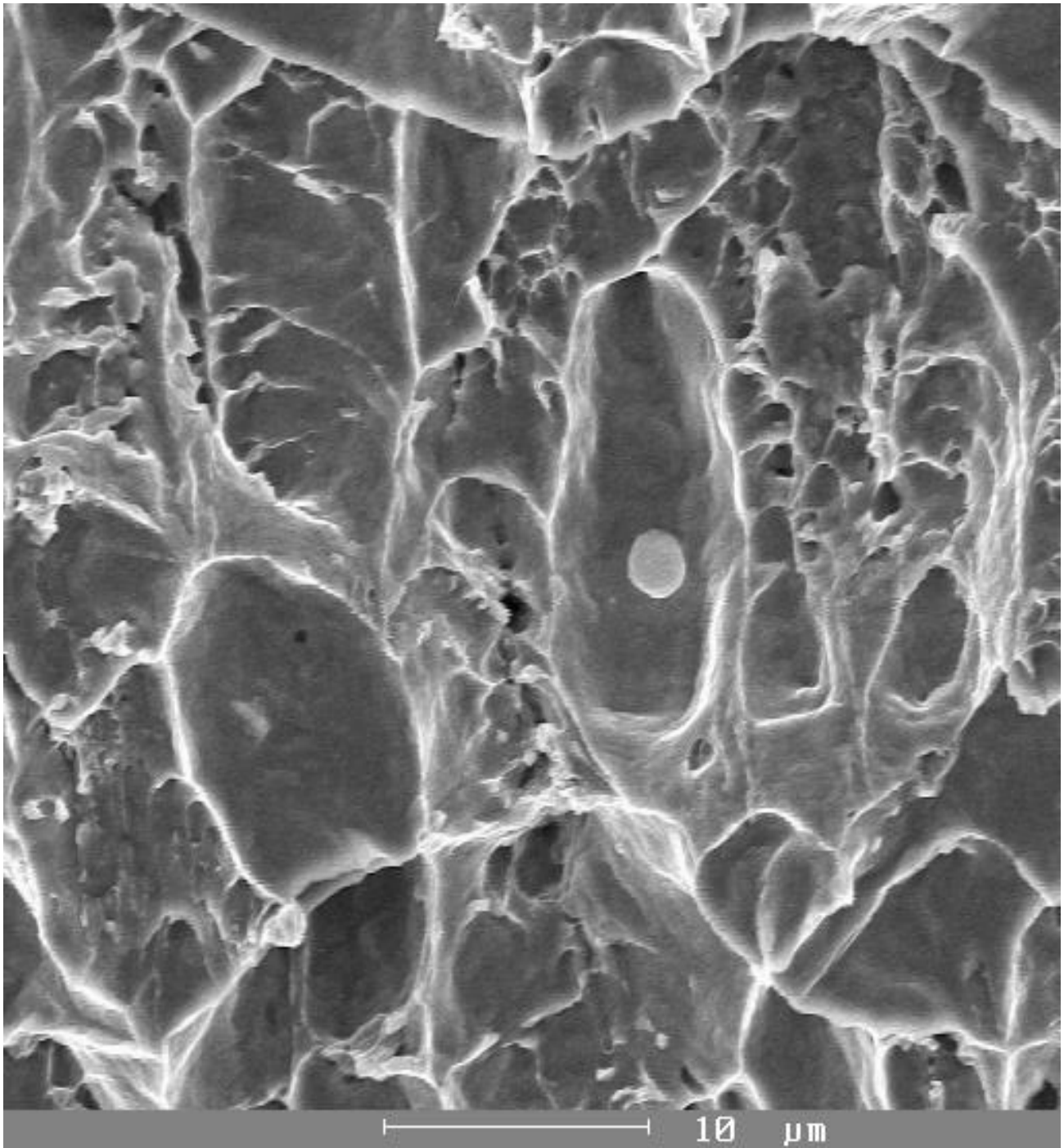
závisí od:

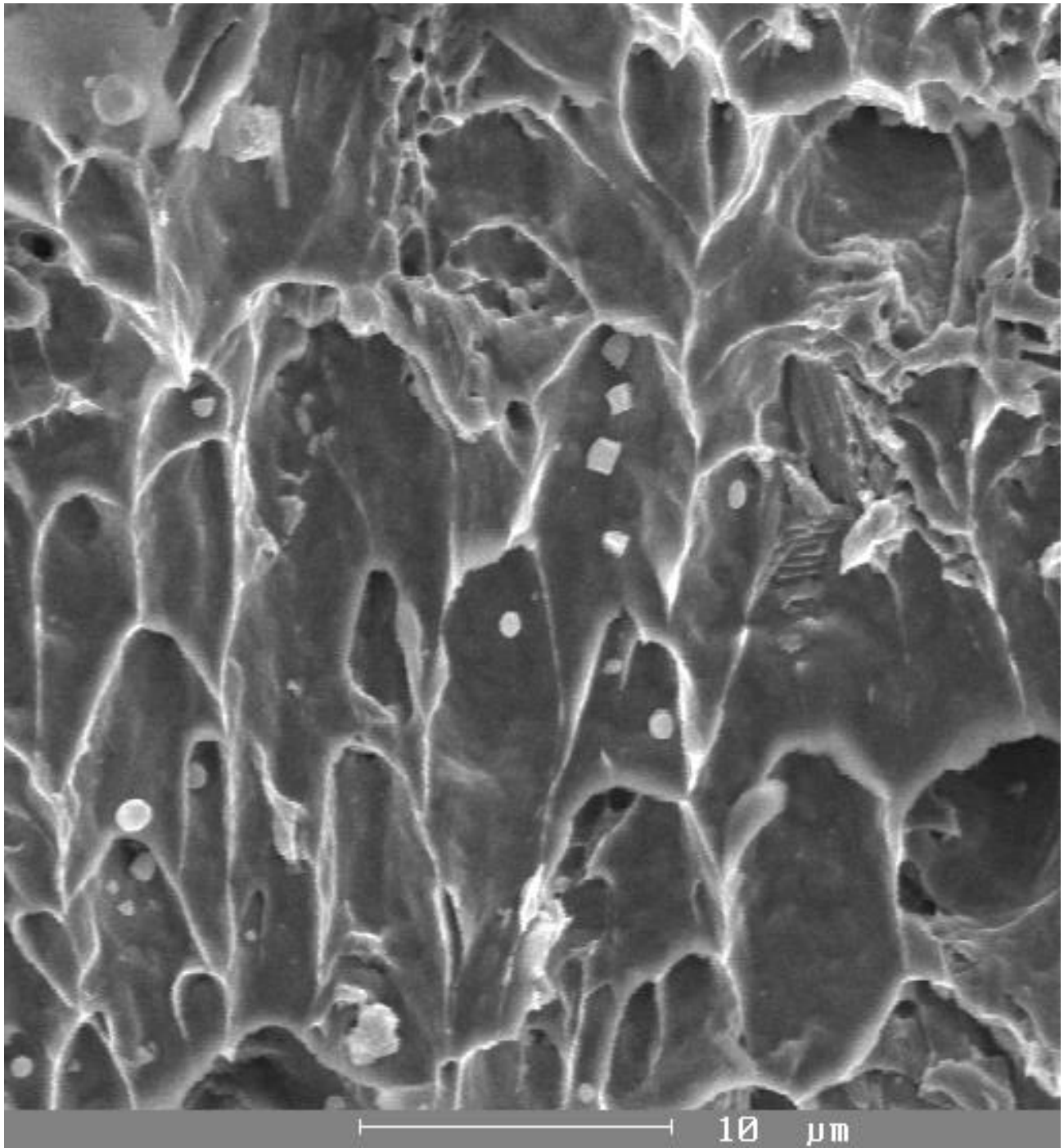
- ⇨ množstva, tvaru, veľkosti a distribúcie zárodkov
- ⇨ tvaru a veľkosti zŕn
- ⇨ stavu štruktúry
- ⇨ deformačnej histórie materiálu
- ⇨ stavu napätosti
- ⇨ rýchlosti deformácie
- ⇨ veľkosti nahromadenej elastickej a plastickej deformácie






25 µm

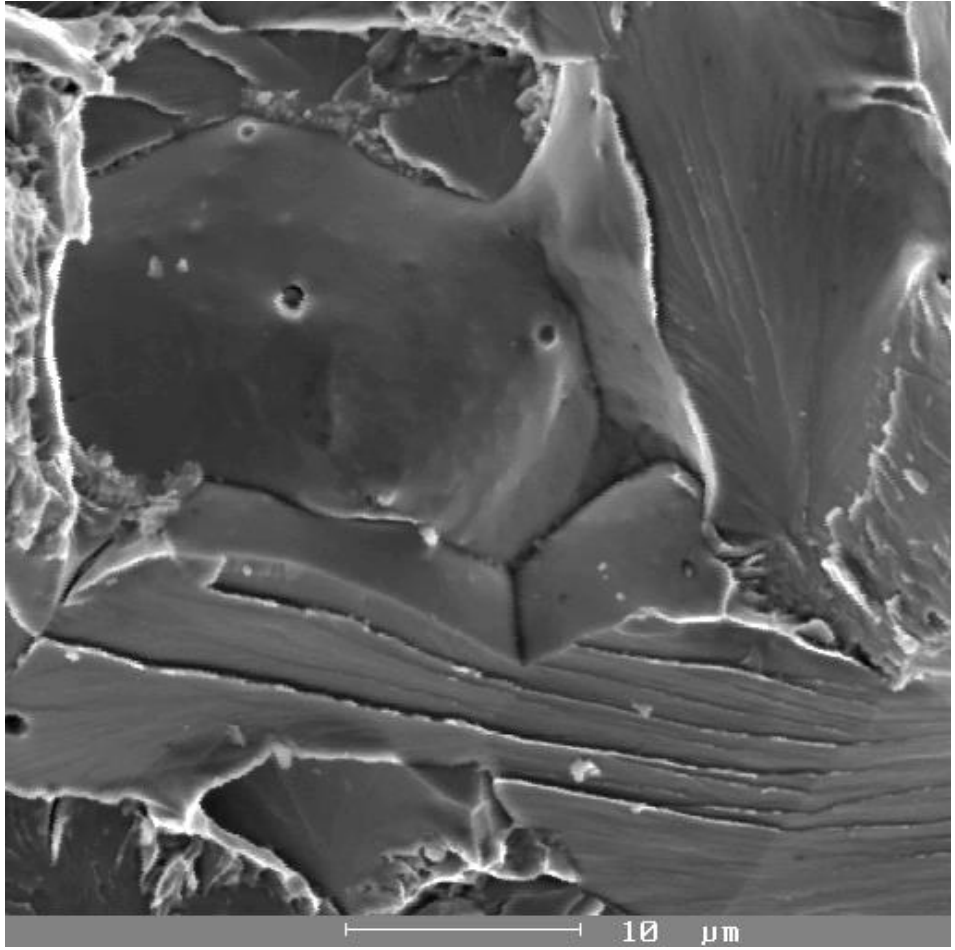

10 µm


10 µm

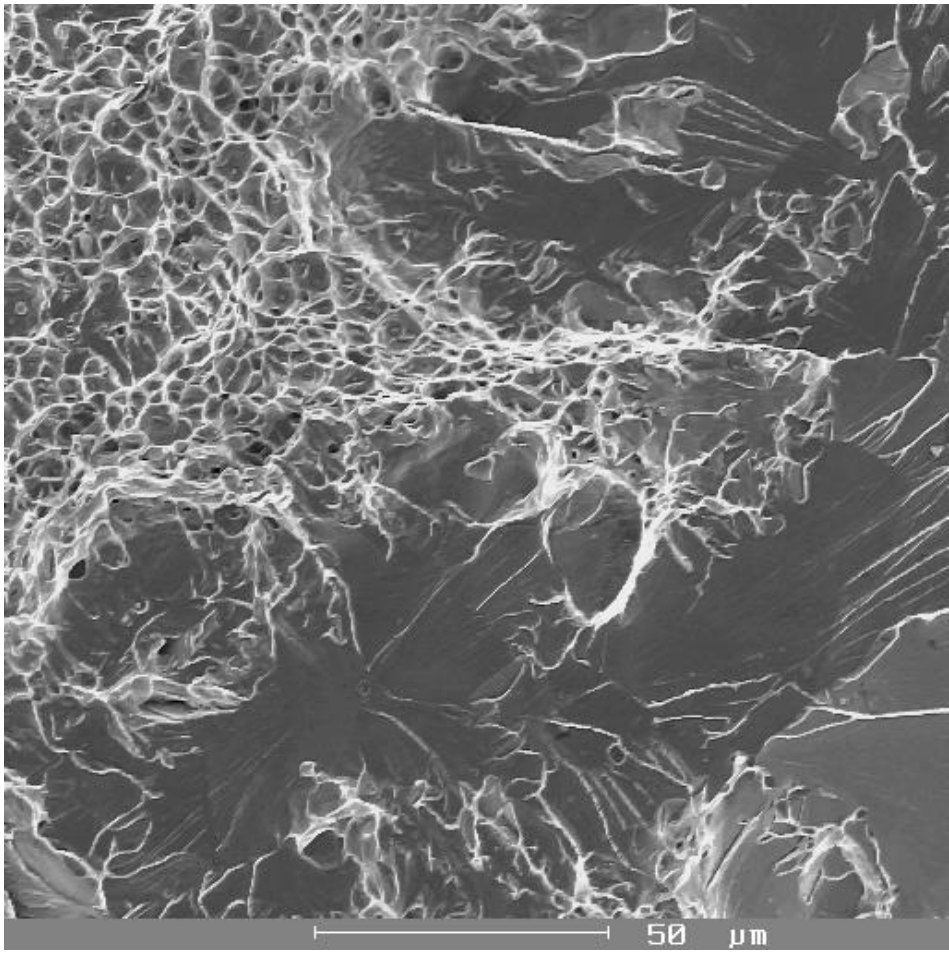
Pri šírení magistrálnej trhliny cez prierez telesa sa môže mechanizmus vzniku lomu meniť. Lomová plocha potom predstavuje súbor faziet rôzneho typu porušení.

Závisí to od:

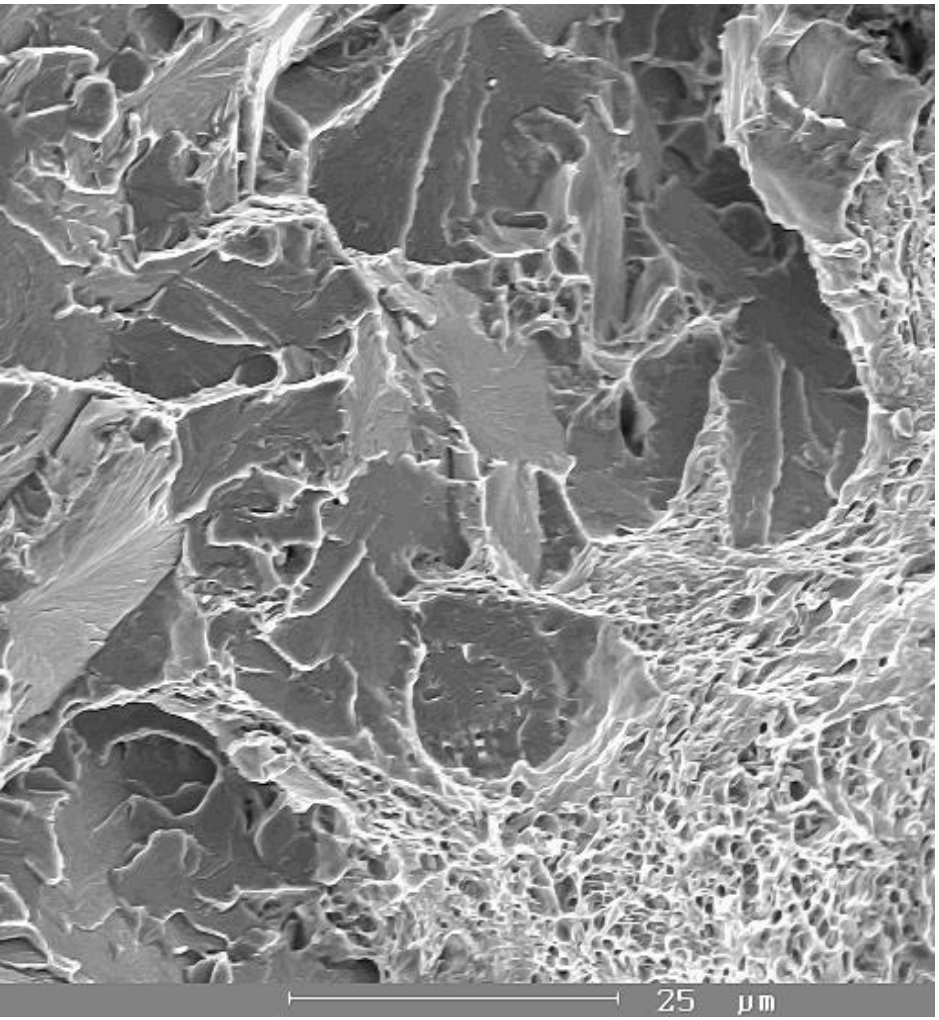
- ⇨ množstva, tvaru, veľkosti a distribúcie zárodkov,
- ⇨ tvaru a veľkosti zŕn,
- ⇨ stavu štruktúry,
- ⇨ deformačnej histórie materiálu,
- ⇨ stavu napätosti,
- ⇨ rýchlosti deformácie,
- ⇨ veľkosti nahromadenej elastickej a plastickej deformácie.

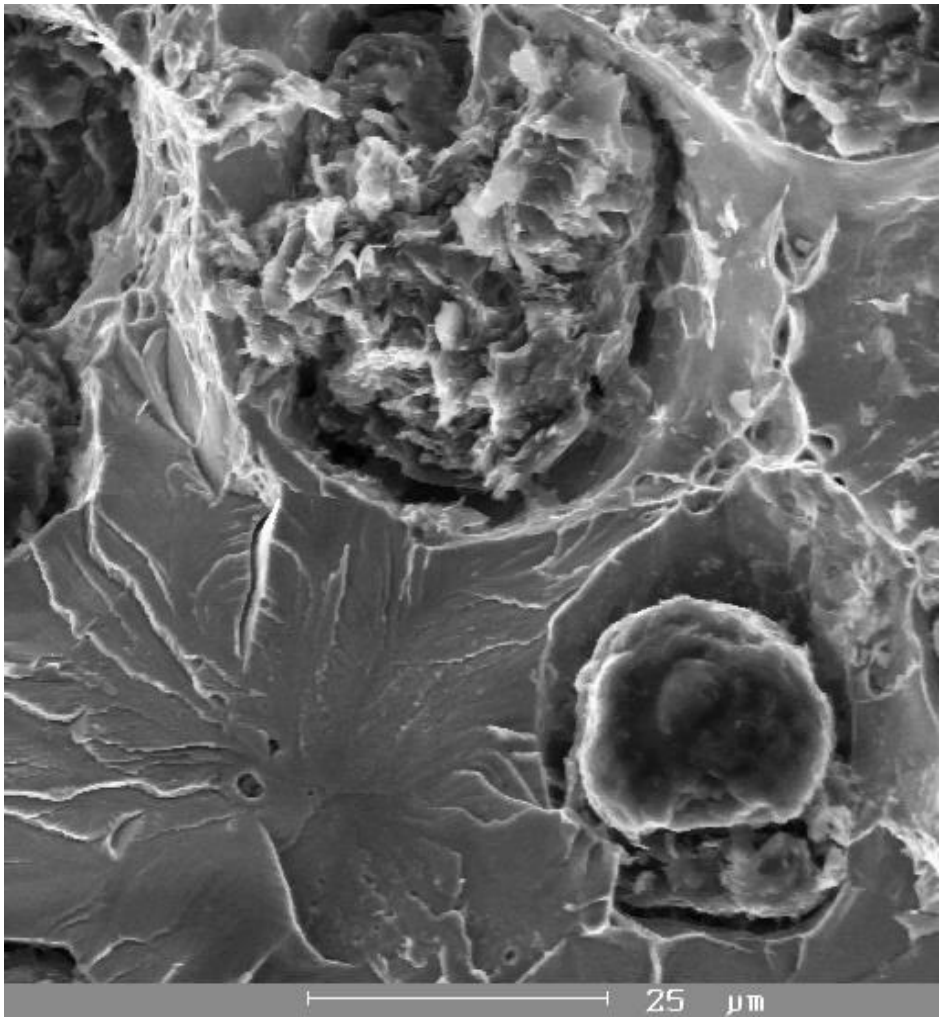


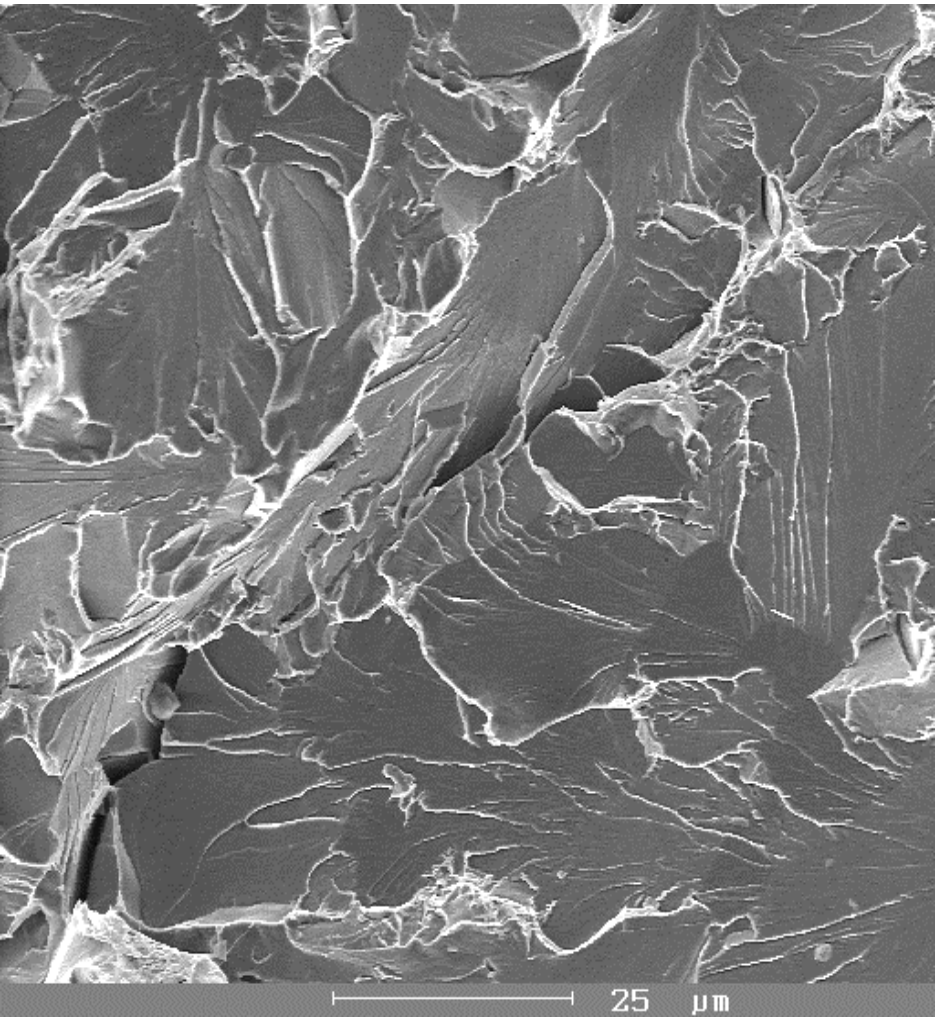
Zmiešané interkryštalické a transkryštalické a porušenie štiepením

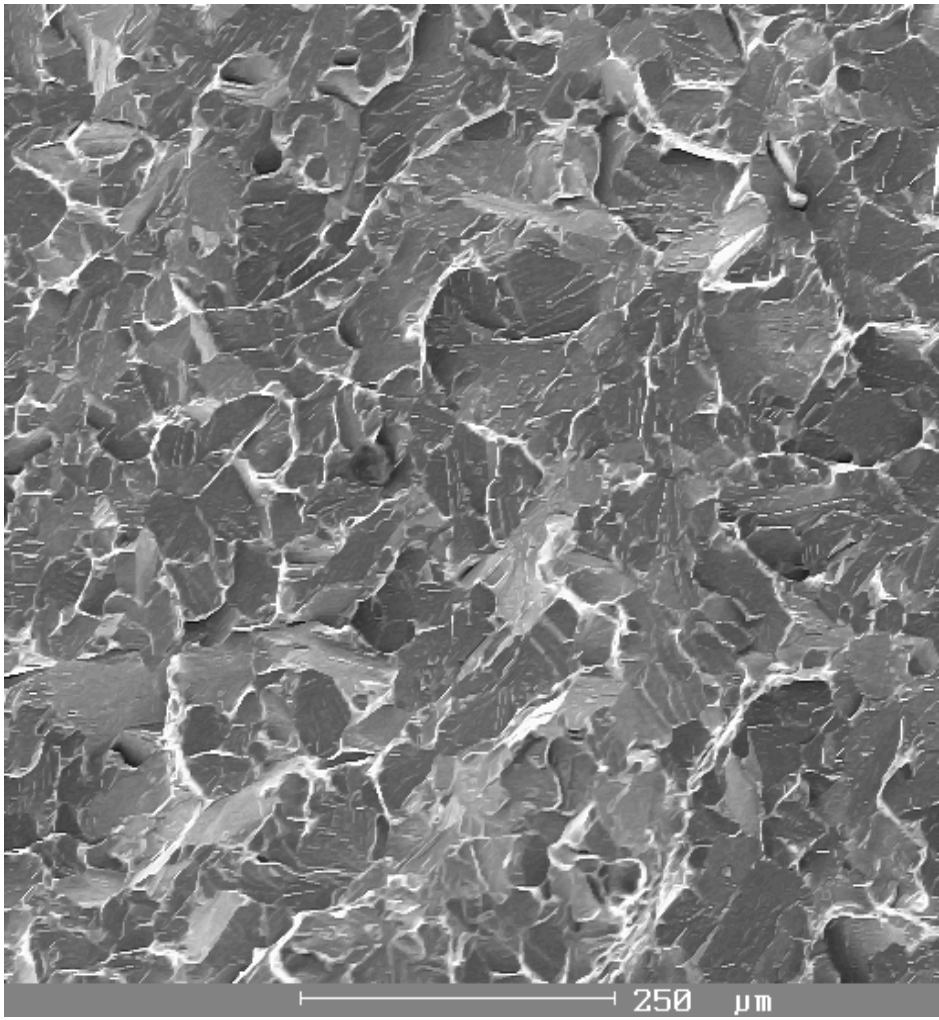


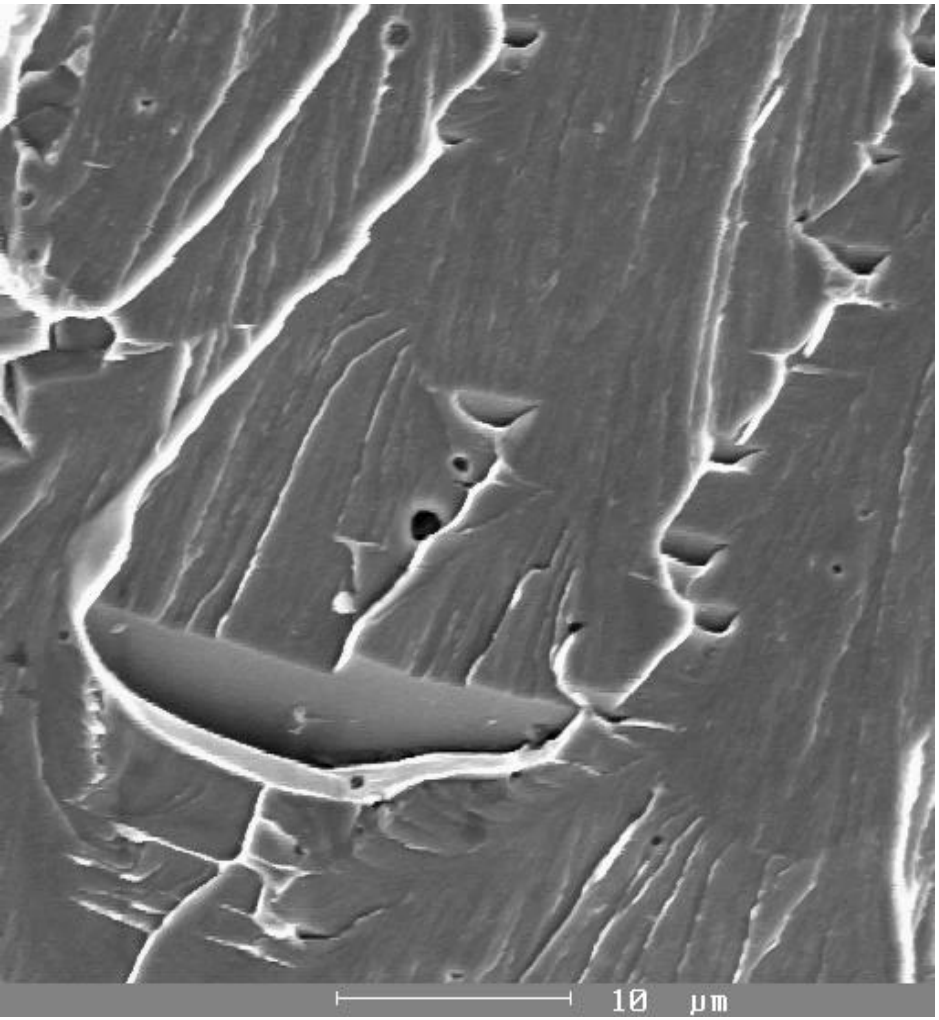
Zmiešané transkryštalické tvárne a porušenie štiepením

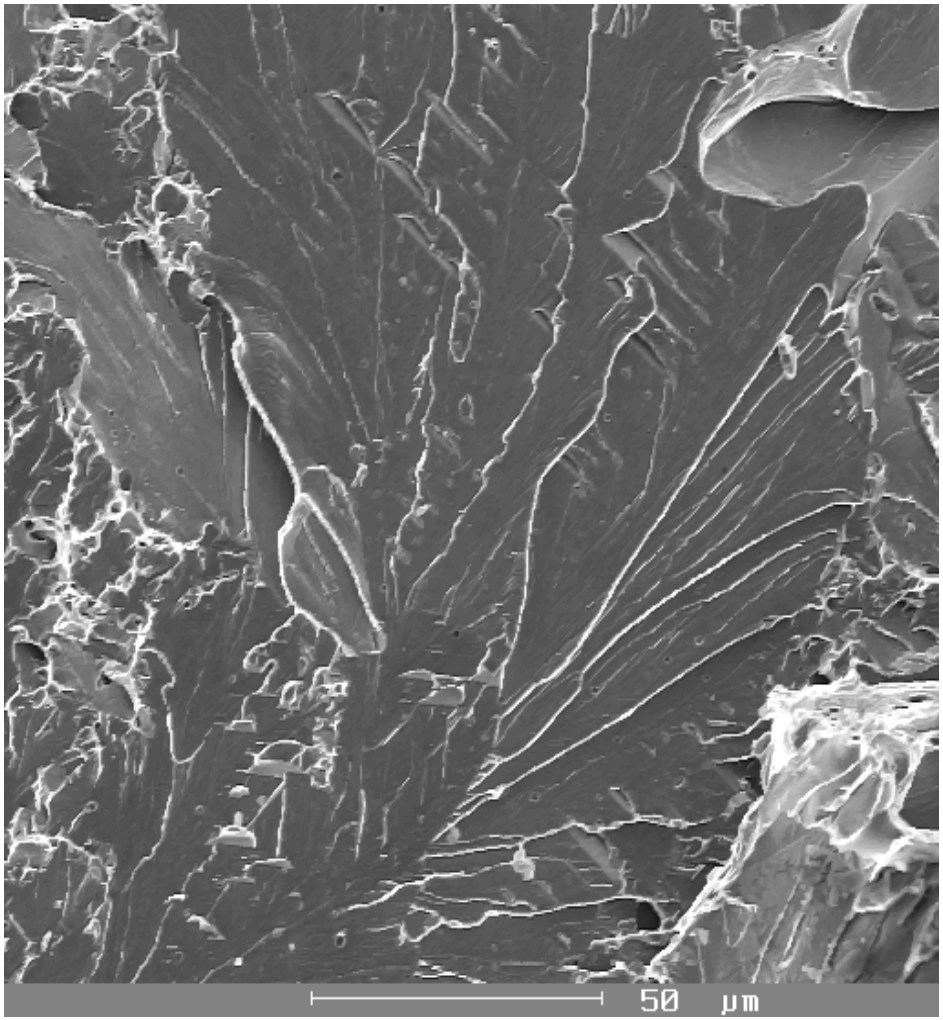

25 µm

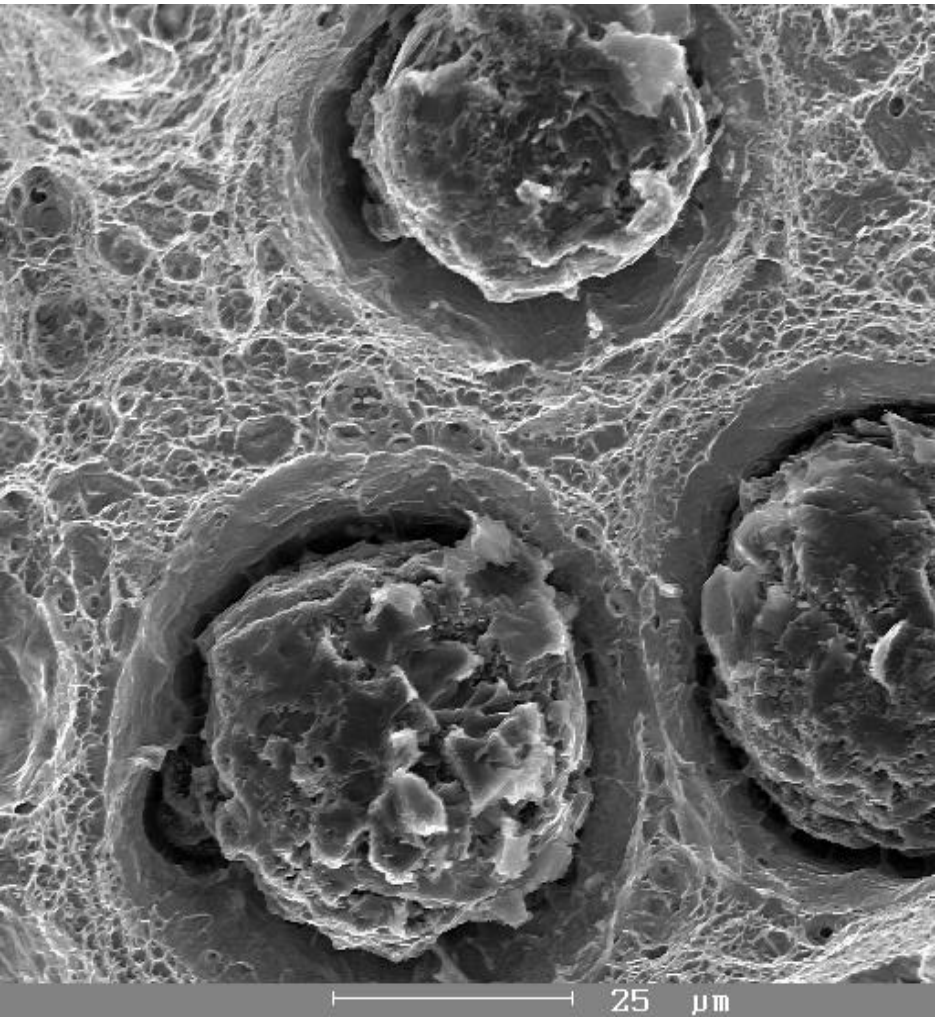

25 µm

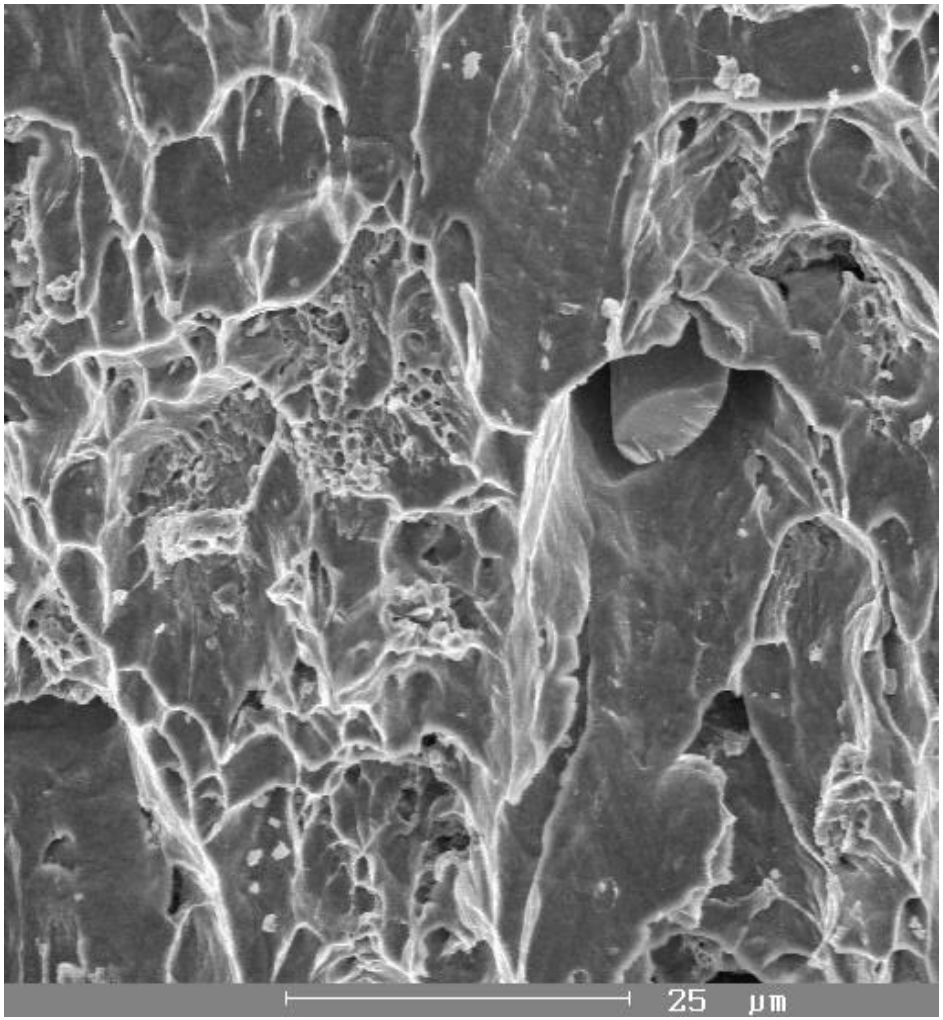

25 µm

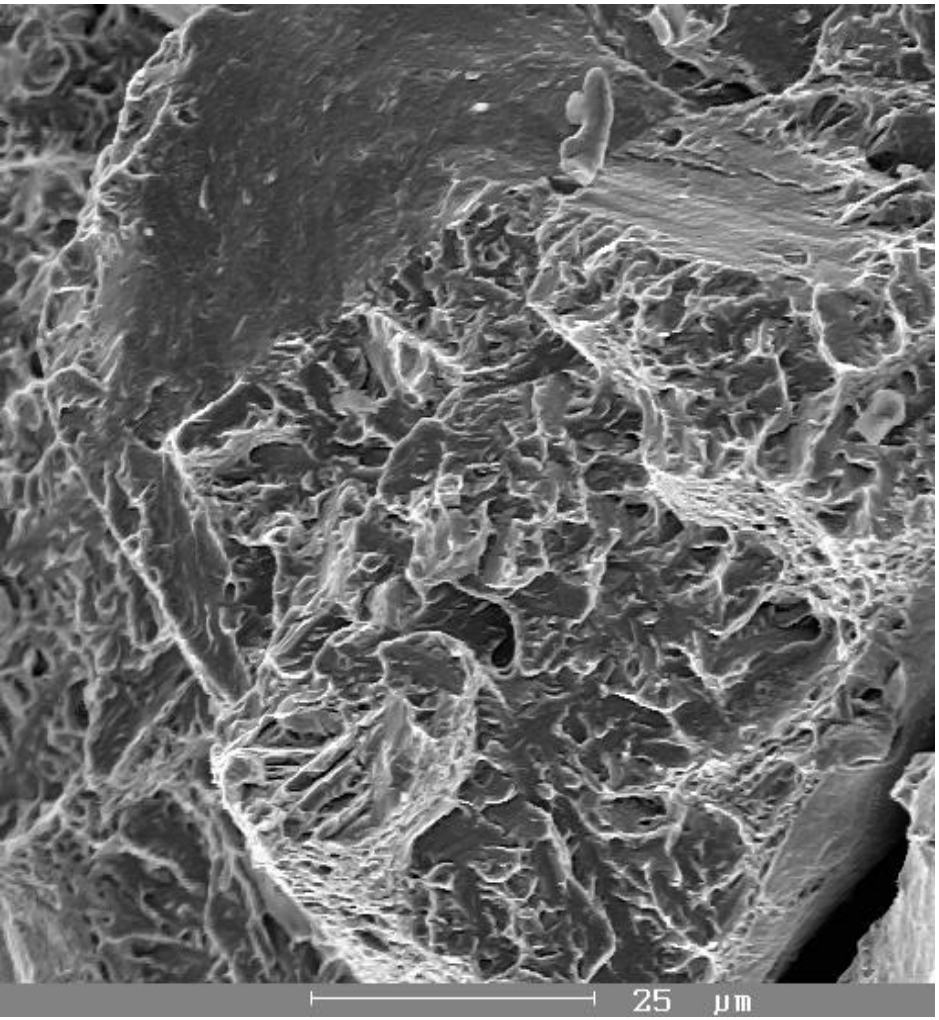

250 µm

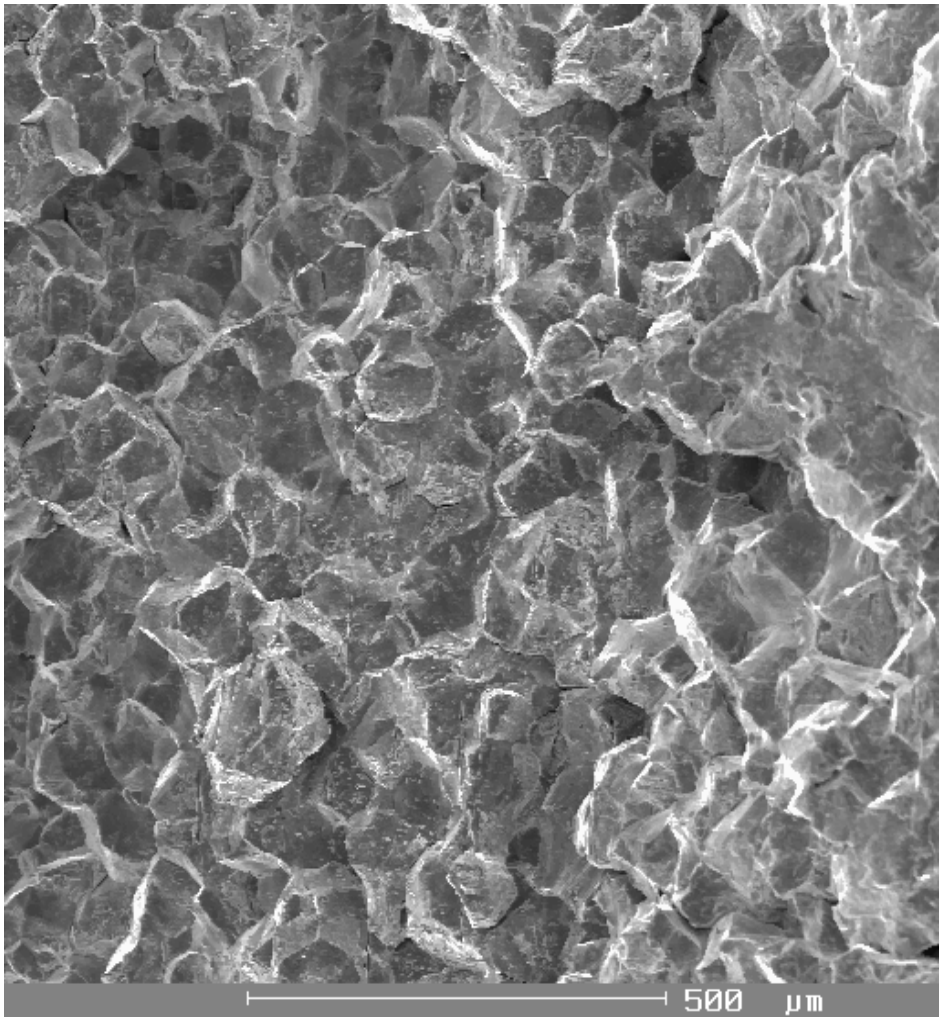

10 µm

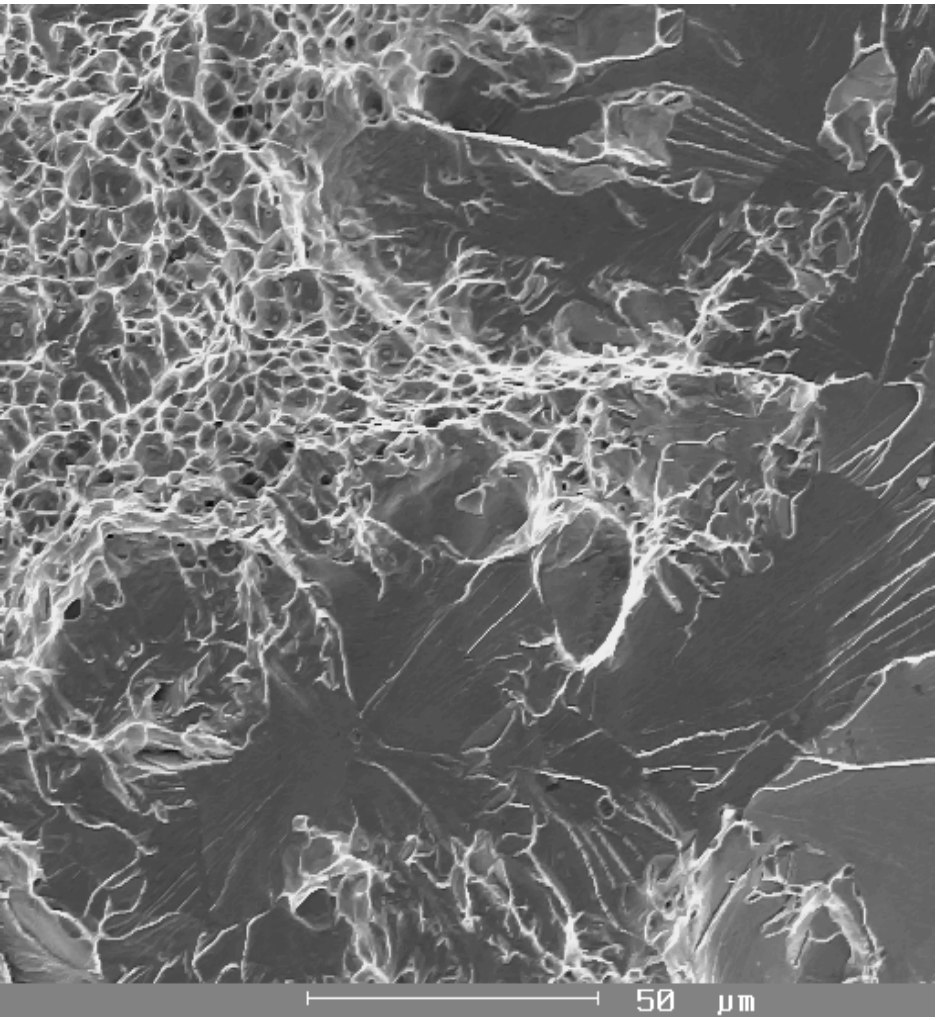

50 µm

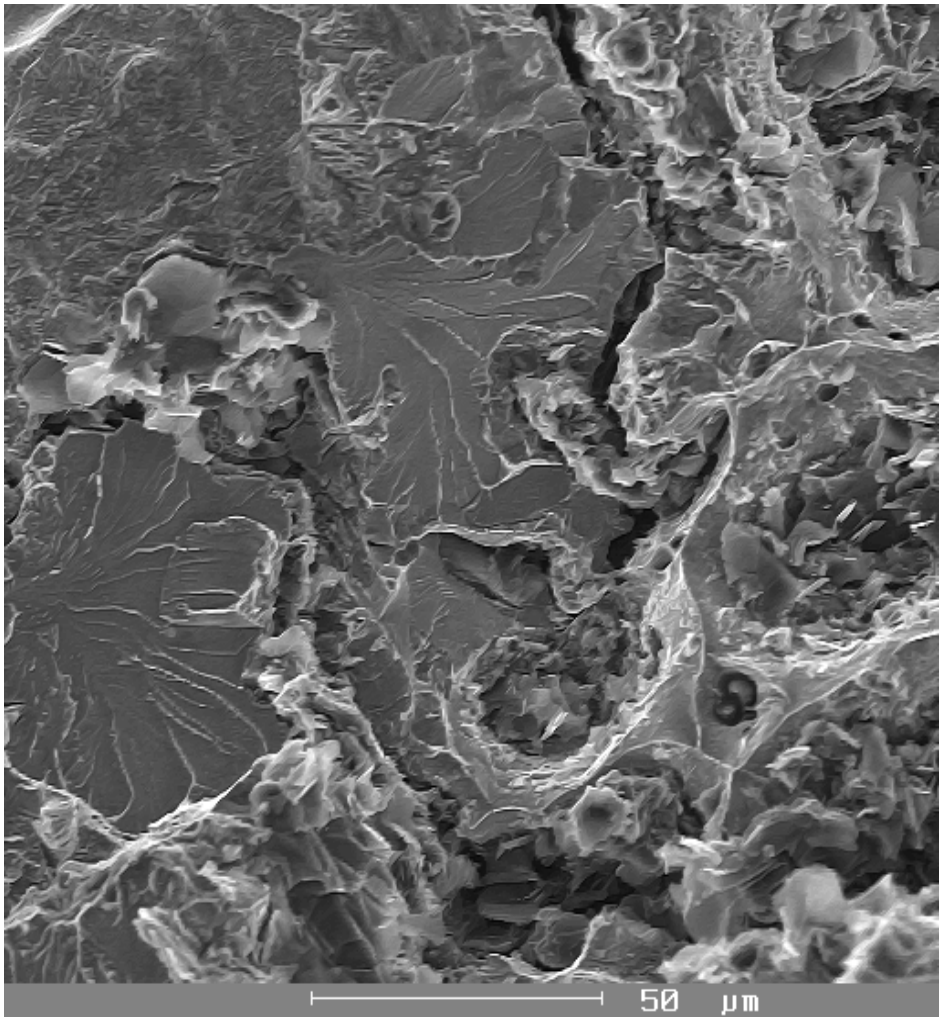

25 µm


25 µm


25 µm


500 µm


50 µm


50 µm