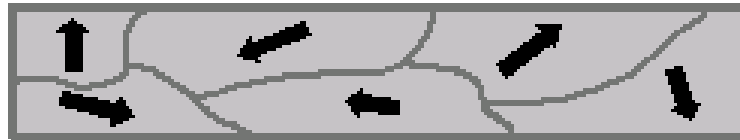


**Ispitivanje magnetskim česticama
- MT -**

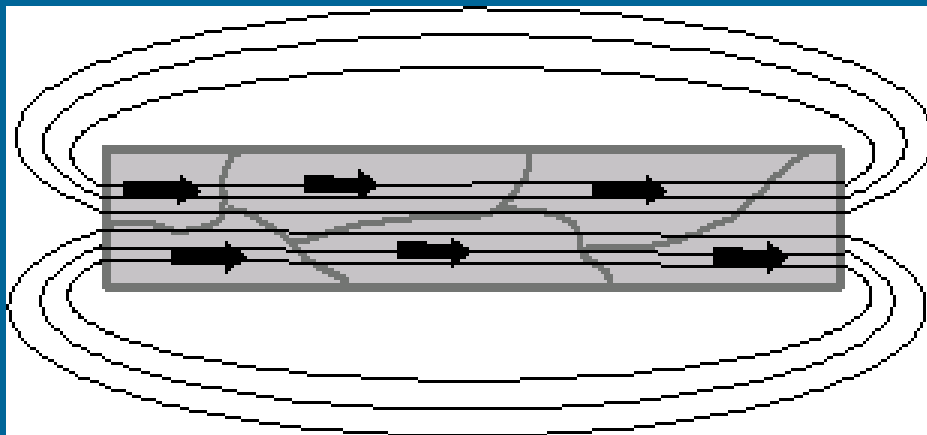
Magnetic Particle Testing

Damir Markučić

MT - princip

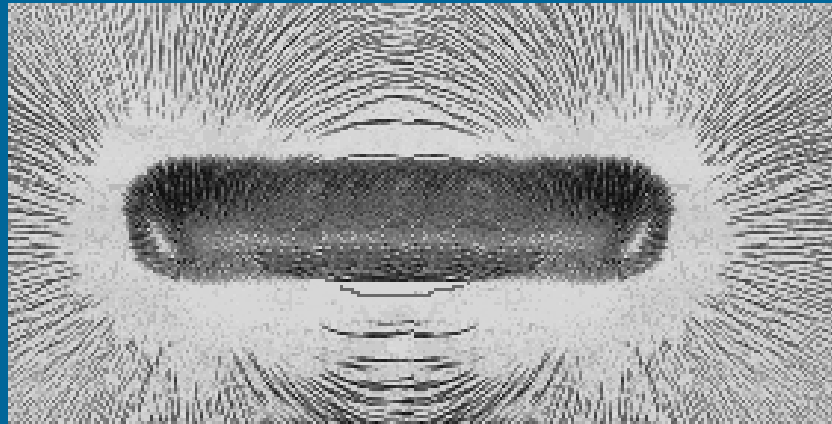


“normalno” stanje

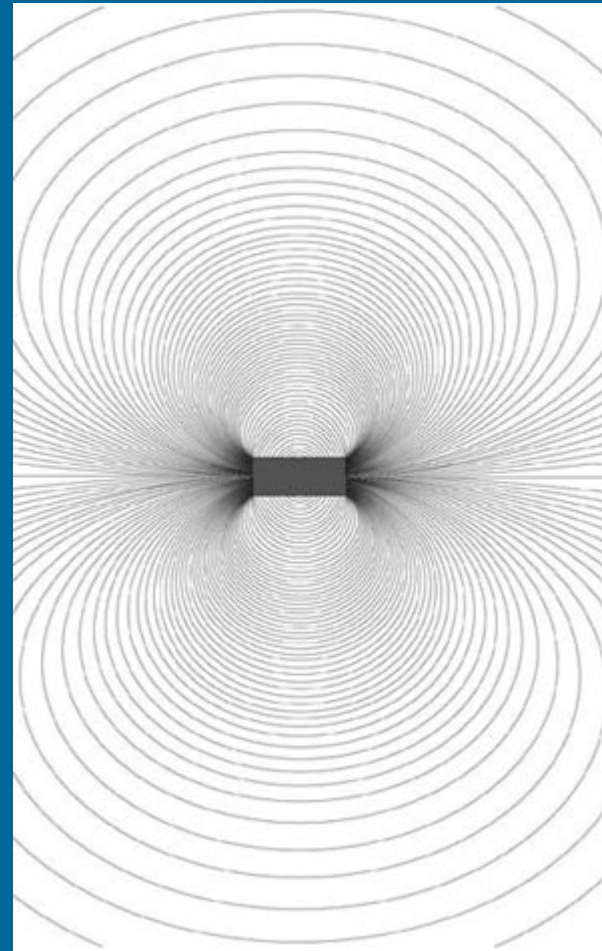


magnetizirano stanje

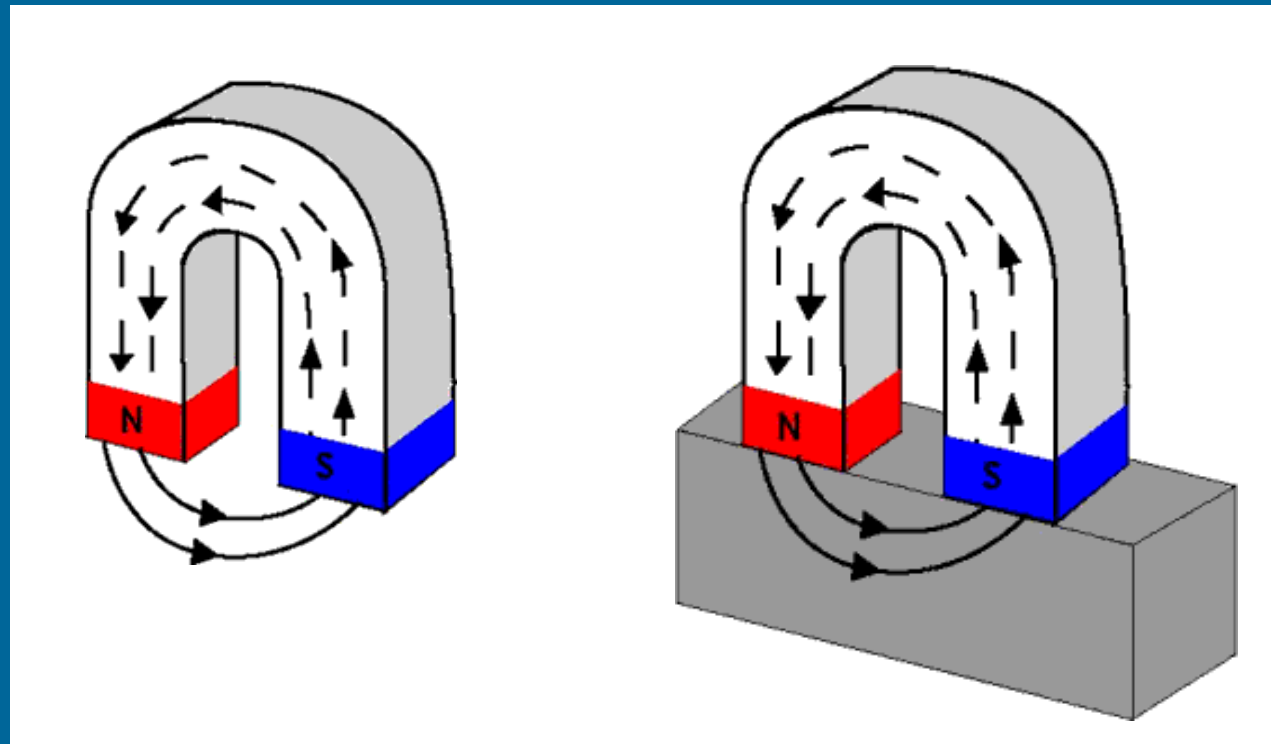
MT - princip



- silnice magnetskog polja
- magnetski tok, gustoća toka

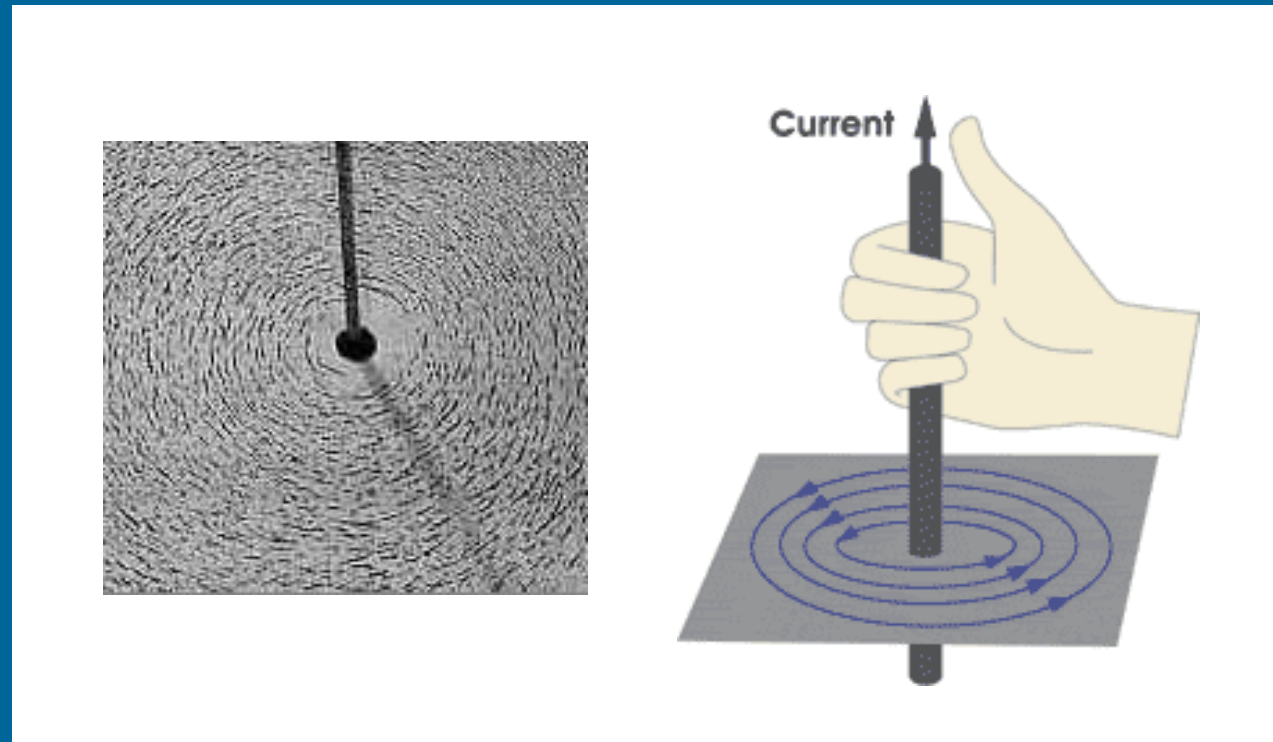


MT - princip



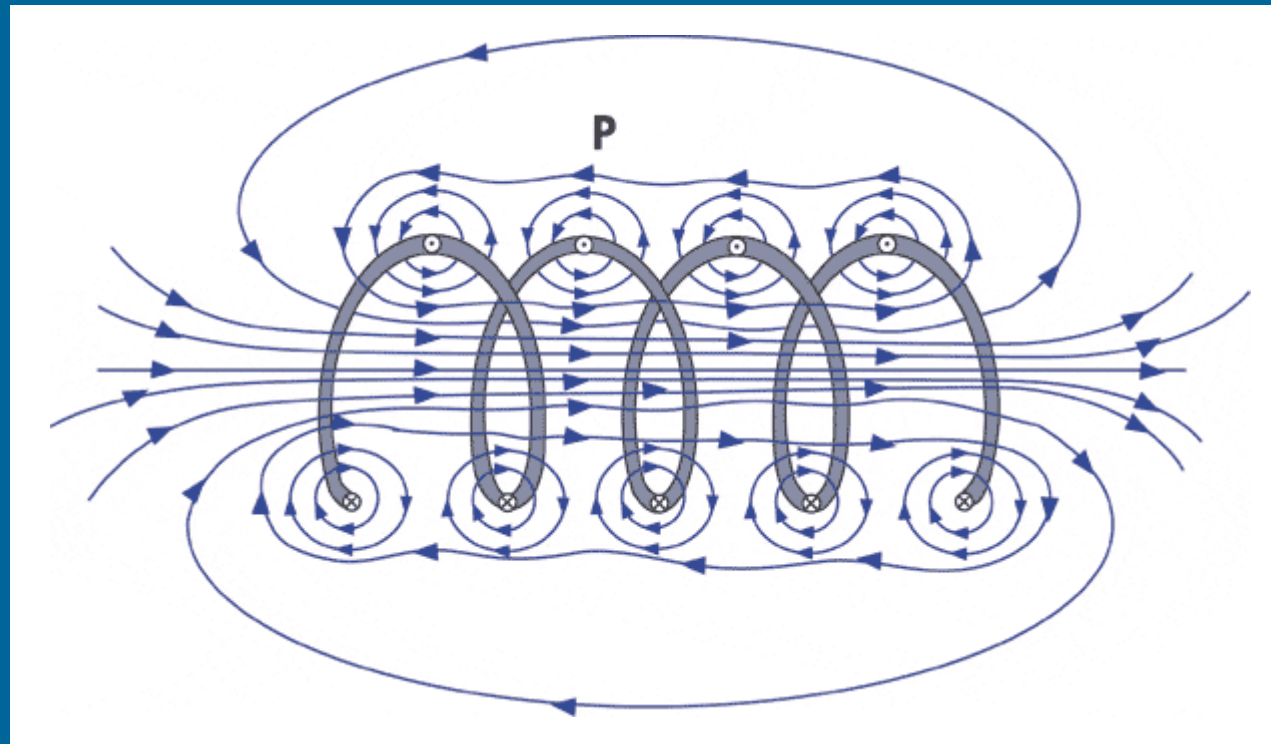
“zatvaranje” magnetskog toka kroz različite medije - permeabilnost

MT - princip



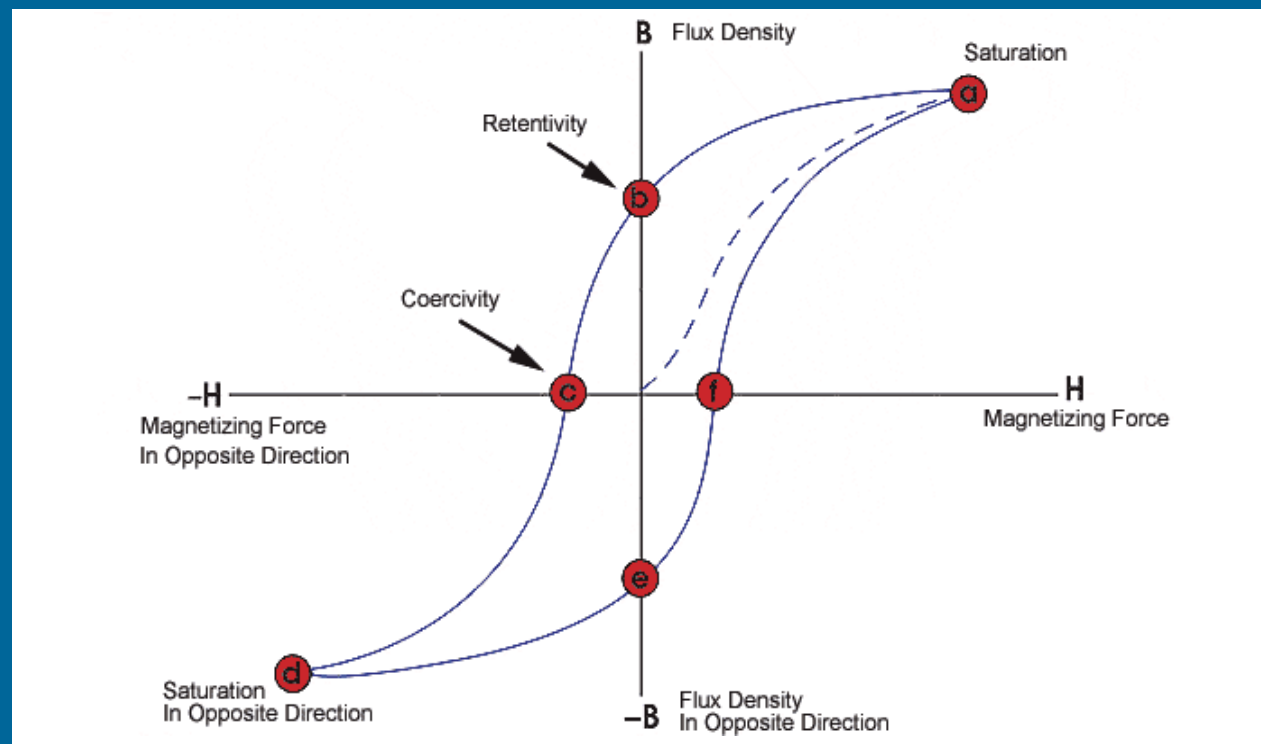
elektromagnetska indukcija – induciranje
magnetskog polja pomoću el. struje

MT - princip



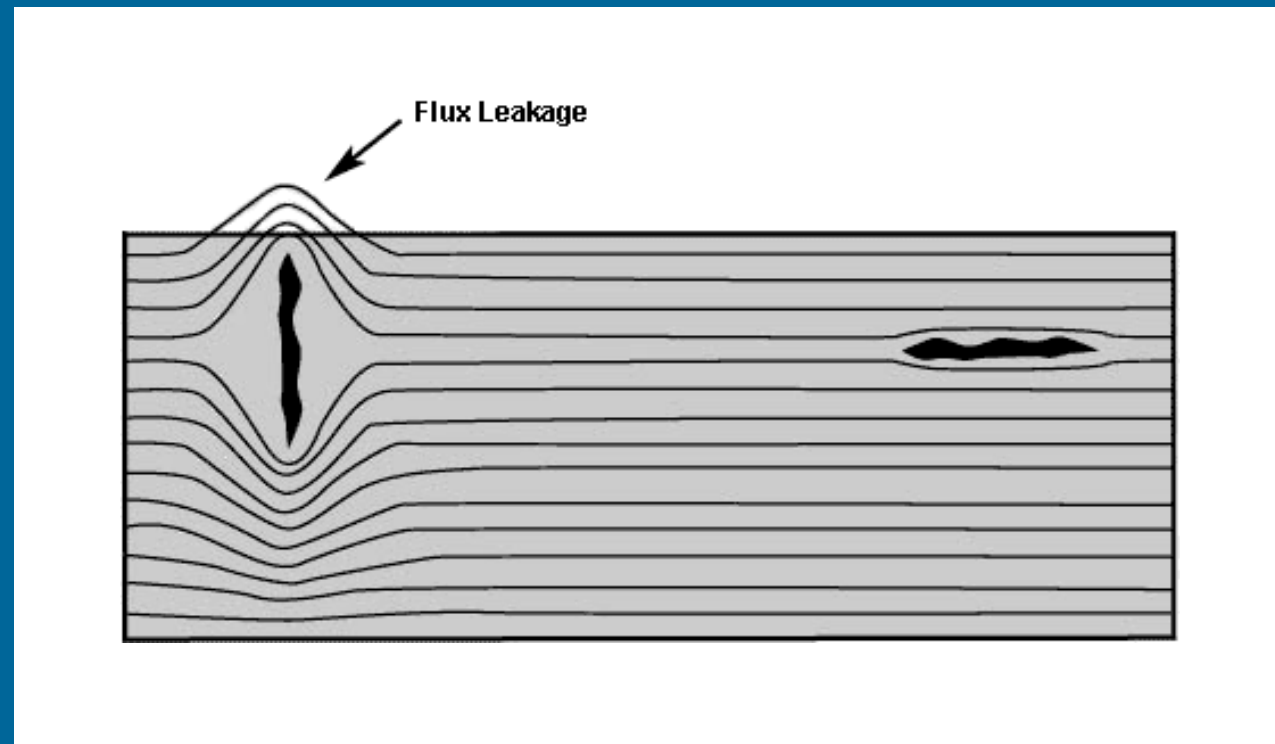
magnetsko polje inducirano zavojnicom

MT - princip



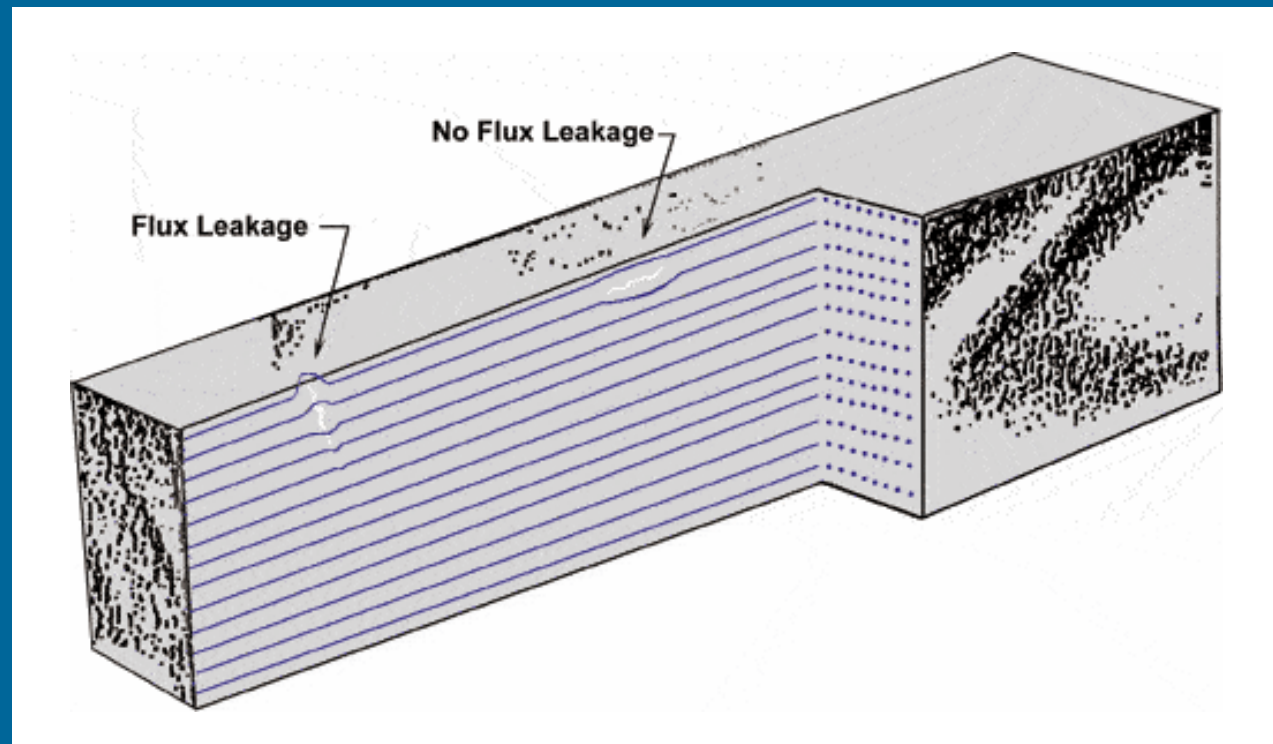
krivulja histereze

MT - princip



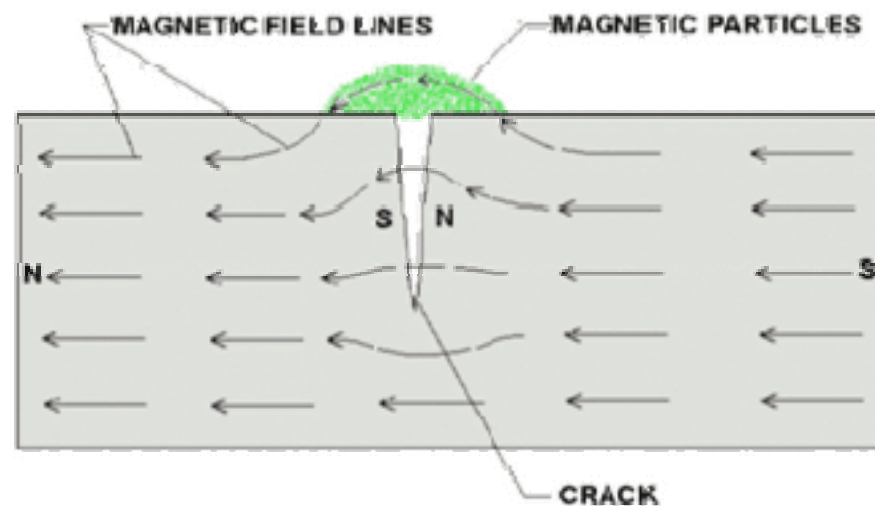
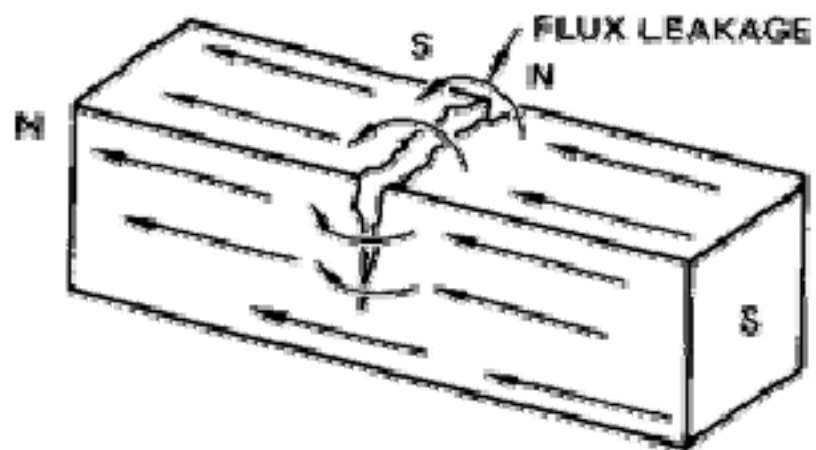
distorzija polja uslijed nepravilnosti

MT - princip

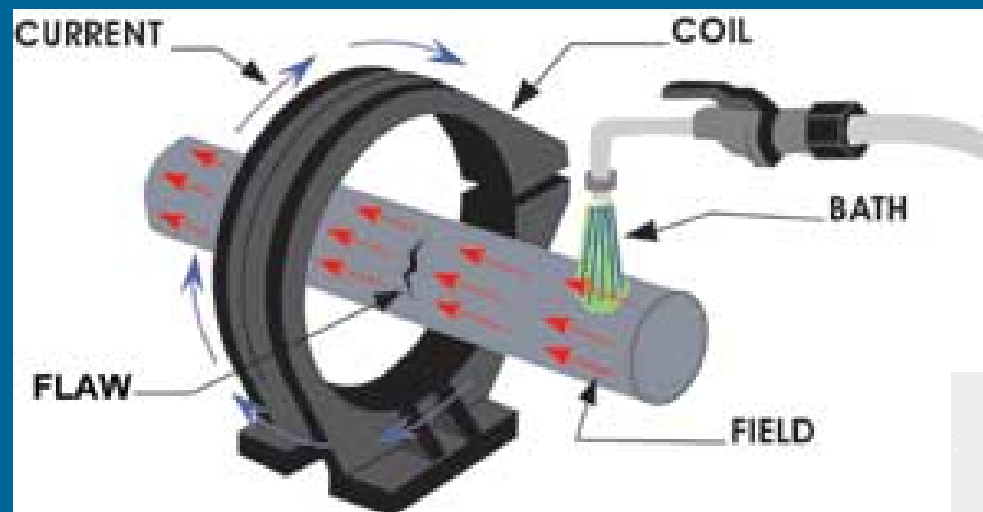


“odziv” (*flux leakage*) na ispitnoj površini ovisno o orijentaciji nepravilnosti

Ispitivanje magnetnim česticama (MT)

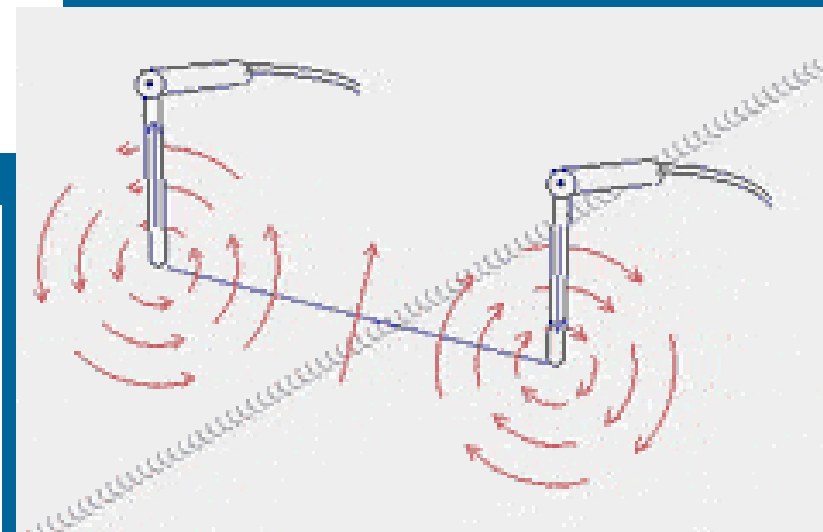
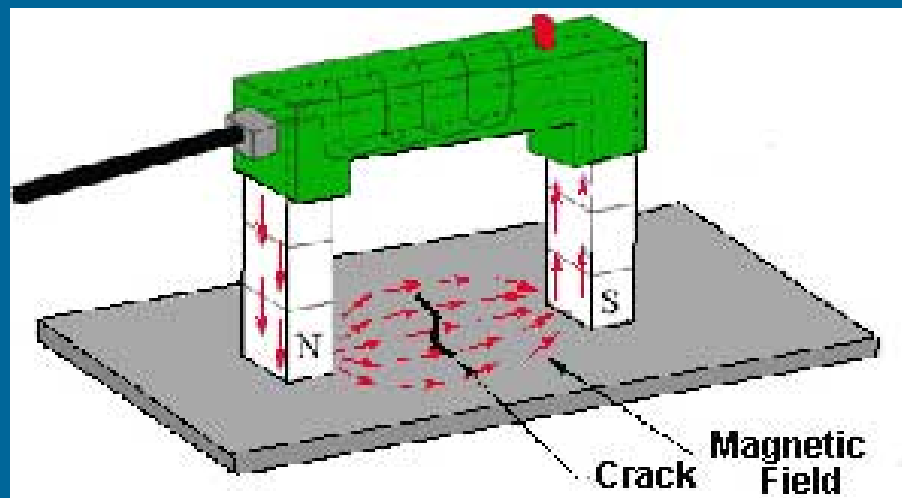


MT – tehnike magnetizacije



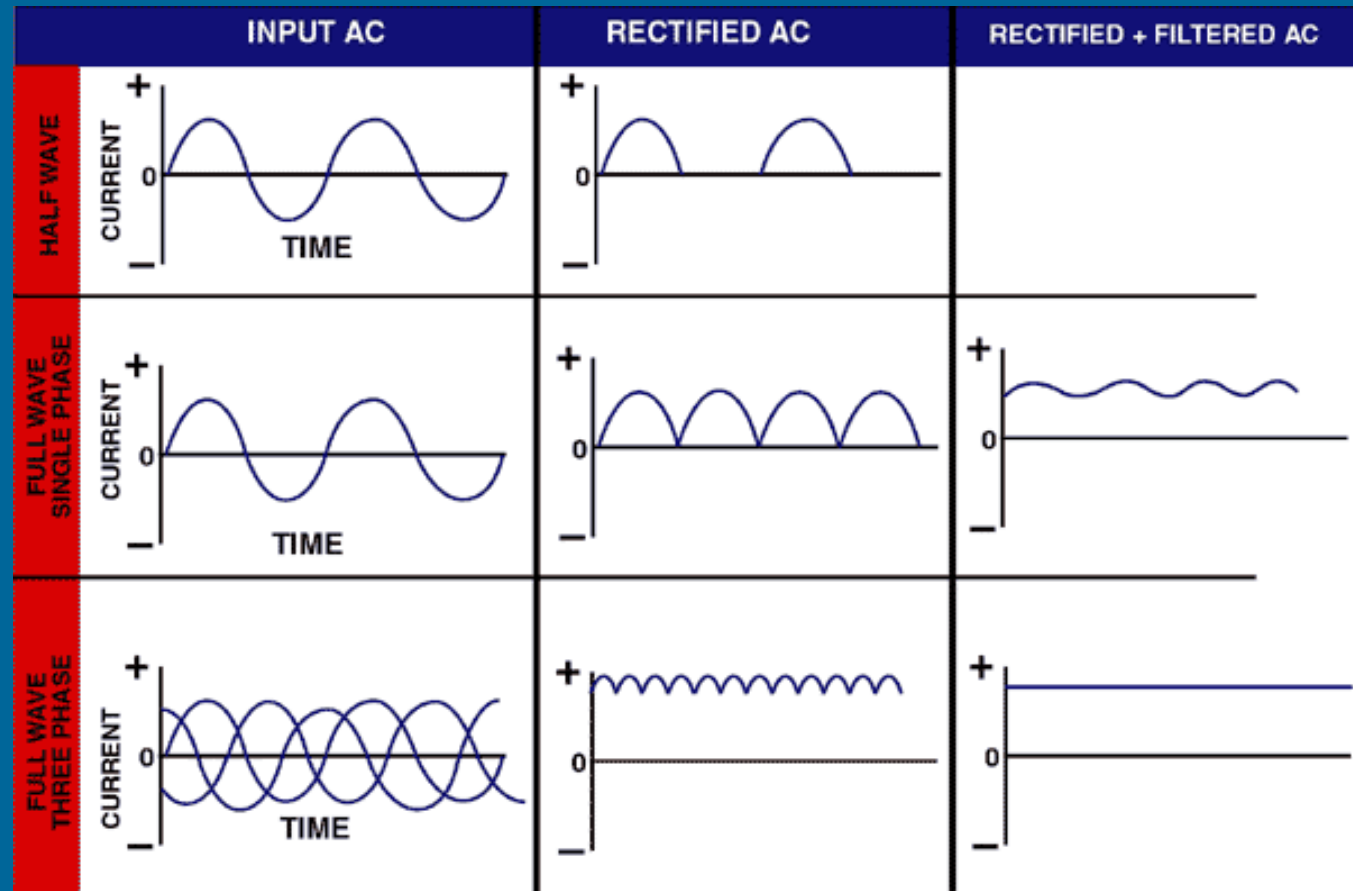
zavojnicom

elektrodnim uređajem



jaram

MT – struja magnetizacije



različita “penetracija” za AC i DC pobudu

MT – čestice

- fluorescentne
- crne +
podložna boja
- suhe
- mokre
 - suspenzija
 - koncentrat



MT – opća načela

- ⇒ samo feromagnetski materijali !!!
“tvrđi” - npr. martenzitni č., manji μ , veći H
i “meki” - npr. niskolegirani č., veći μ , manji H
- ⇒ dva međusobno okomita smjera magnetizacije !
- ⇒ jakost mag. polja $> 2 \text{ kA/m}$
- ⇒ preko sloja premaza $< 50 \text{ }\mu\text{m}$
- ⇒ odnos “širina – dubina – duljina” nepravilnosti: 1 – 10 – 50
- ⇒ veličina čestica 0,1 μm do 10 μm

MT – primjene & zahtjevi

- ↪ suhe i mokre čestice (uljne i vodene suspenzije)
 - temperaturno područje primjene
 - hrapavost površine
- ↪ uvjeti promatranja: (HRN EN ISO 3059)
 - rasvjeta - min 500 lx;
 - UV - min 1000 $\mu\text{W}/\text{cm}^2$, max 20 lx
- ↪ provjere ispitnog sustava i elemenata sustava
- ↪ **DEMAGNETIZACIJA !**
- ↪ HRN EN ISO 9934-1, HRN EN ISO 9934-2,
HRN EN ISO 9934-3
HRN EN 1290, HRN EN 1291

MT – kriterij prihvatljivosti, HRN EN 1291

↪ Za **linearne** indikacije

Accept. Level 1 $l \leq 1,5$ mm

Accept. Level 2 $l \leq 3,0$ mm

Accept. Level 3 $l \leq 6,0$ mm

↪ Za **ne-linearne** indikacije

Accept. Level 1 $d \leq 2$ mm

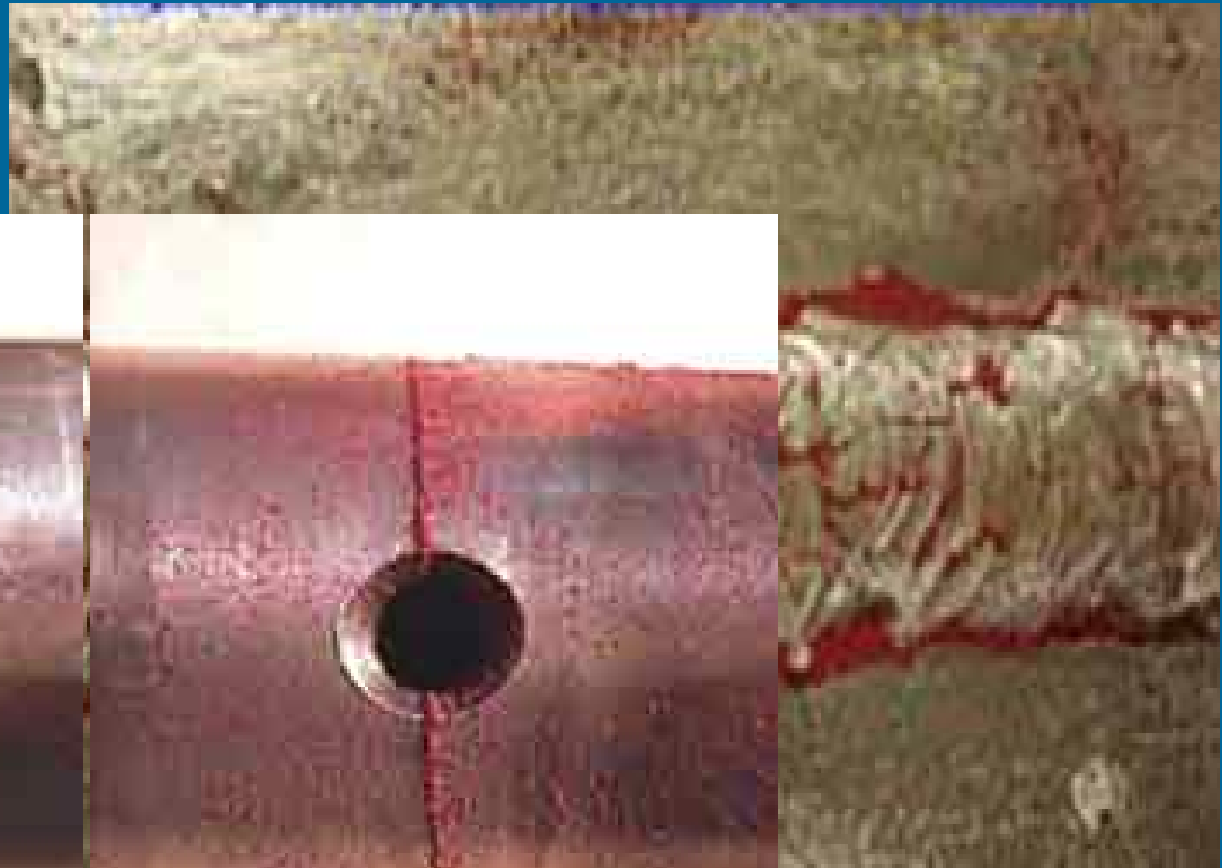
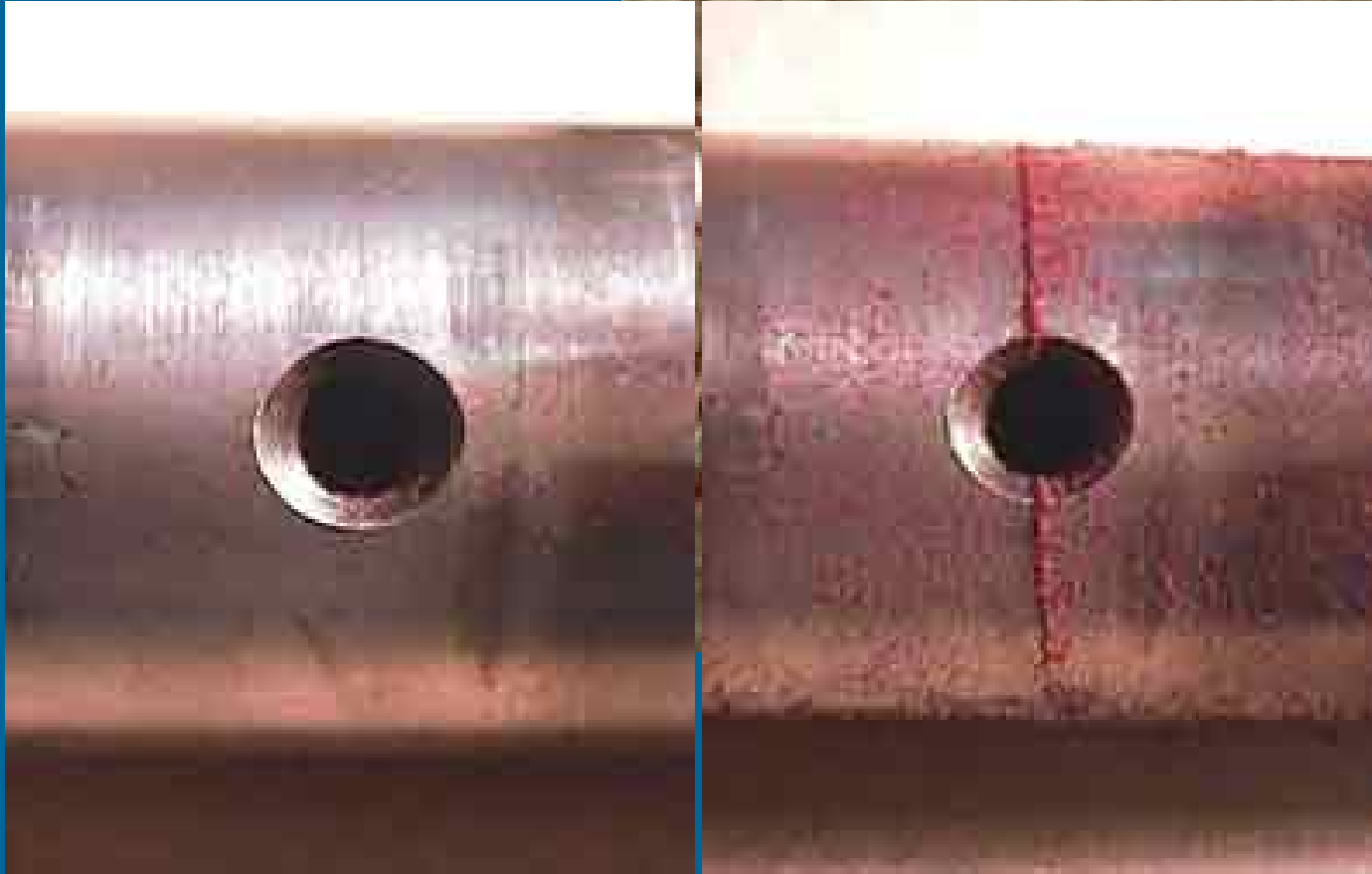
Accept. Level 2 $d \leq 3$ mm

Accept. Level 3 $d \leq 4$ mm

↪ Accept. Levels 2 & 3 mogu imati “X” Level 1 !!!!

Primjeri indikacija za MT

obojene - crvene
magnetne čestice.



Primjeri indikacija za MT

fluorescentne
magnetne čestice.

