

SIMULTANEOUS MICRO EDM AND MICRO ECM

Micro EDM and Micro ECM

- Drawbacks of micro-EDM milling:
 - Rough surface due to overlapped craters
 - Heat-affected-zones
- Sequential micro-EDM and micro-ECM
 - Change machining fluid becomes problematic
- Combine in the same process
 - Different machining fluid ?

Micro EDM and Micro ECM Approach

Micro-EDM
Dielectric fluid

Non-conductive

Micro-ECM
Electrolyte

Conductive

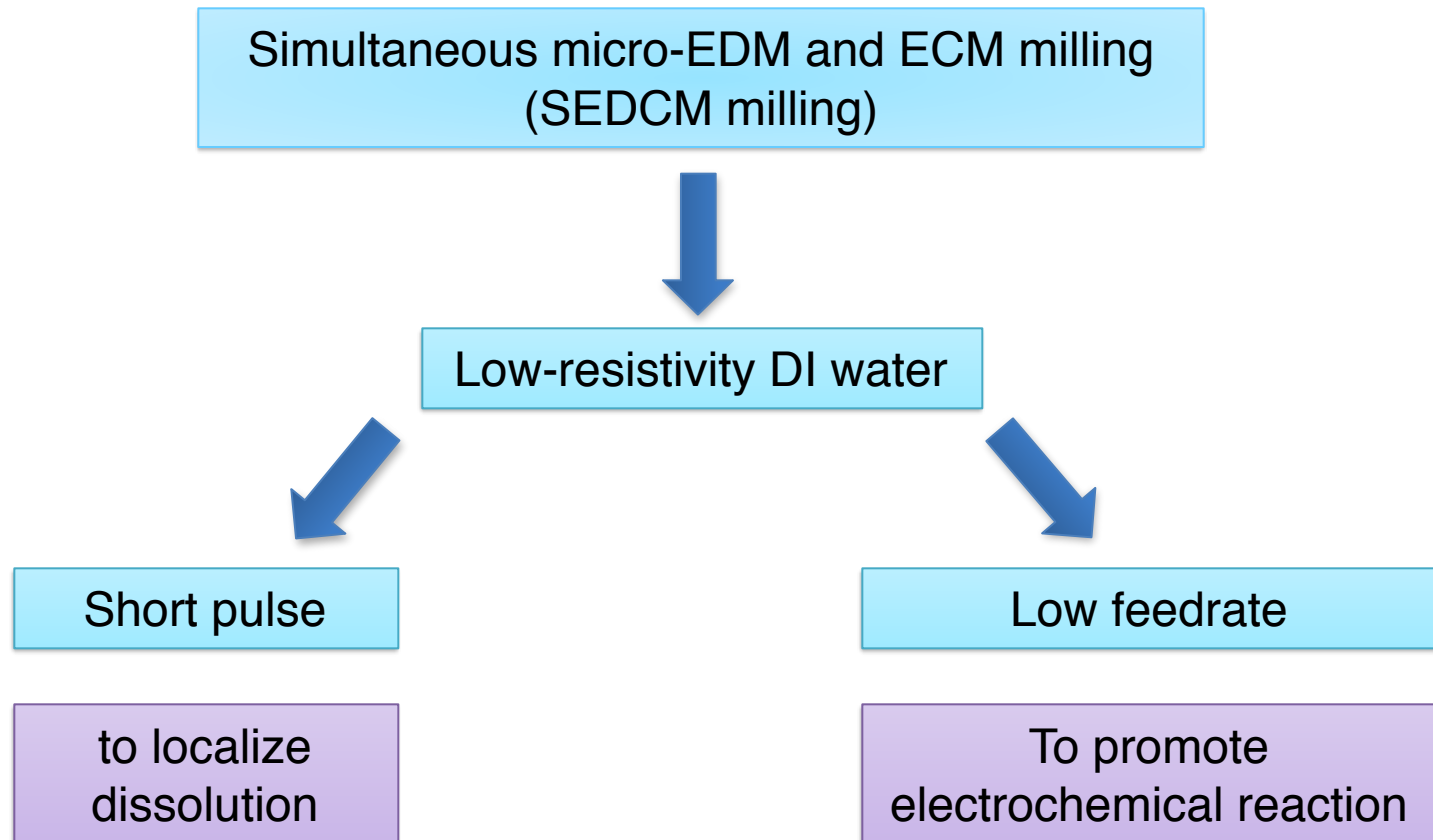
?

Low-resistivity
deionized water

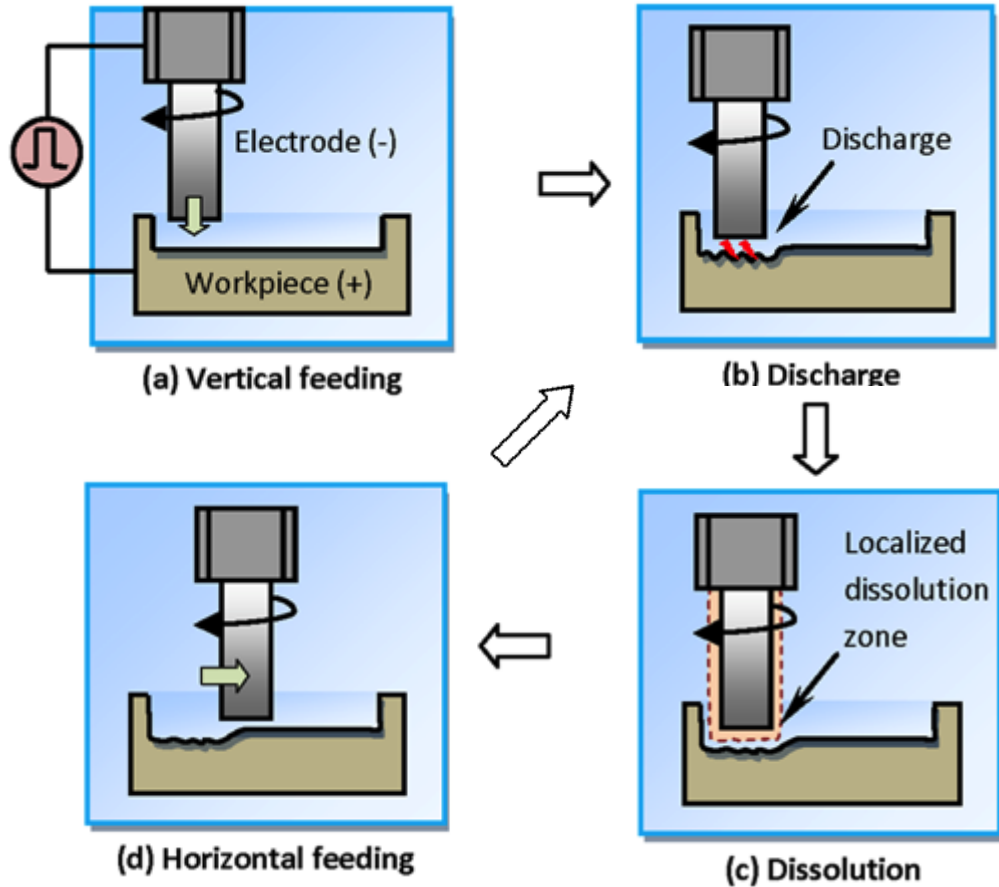
Dielectric strength
 Sparks can occur

Slight conductivity
 Promotes weak electrochemical reaction

Micro EDM and ECM Approach

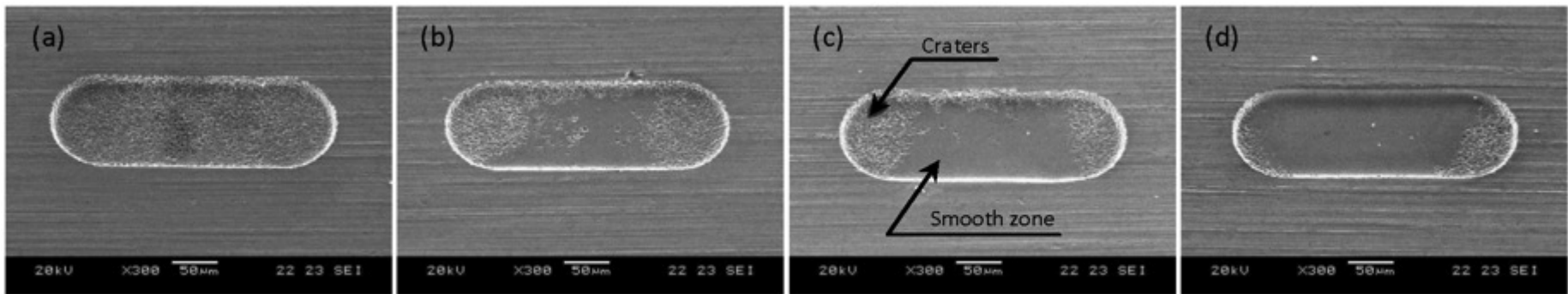


Simultaneous Micro EDM and ECM Milling



Simultaneous Micro EDM and ECM Milling Factors

- Scanning Feedrate



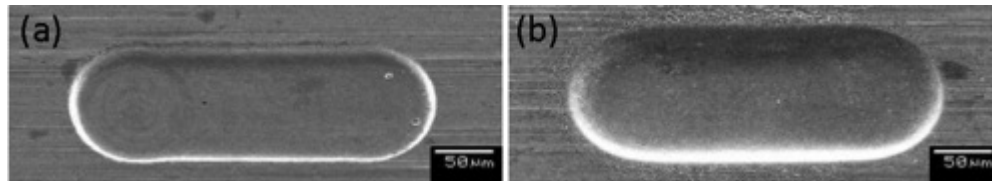
→ Feed reduction

(a) 50 $\mu\text{m/s}$, (b) 30 $\mu\text{m/s}$, (c) 20 $\mu\text{m/s}$, and (d) 10 $\mu\text{m/s}$.

Low feedrate is a requisite for electrochemical reaction

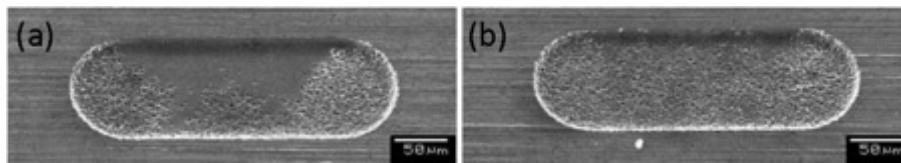
Simultaneous Micro EDM and ECM Milling Factors

- Short voltage pulses to localize dissolution zone



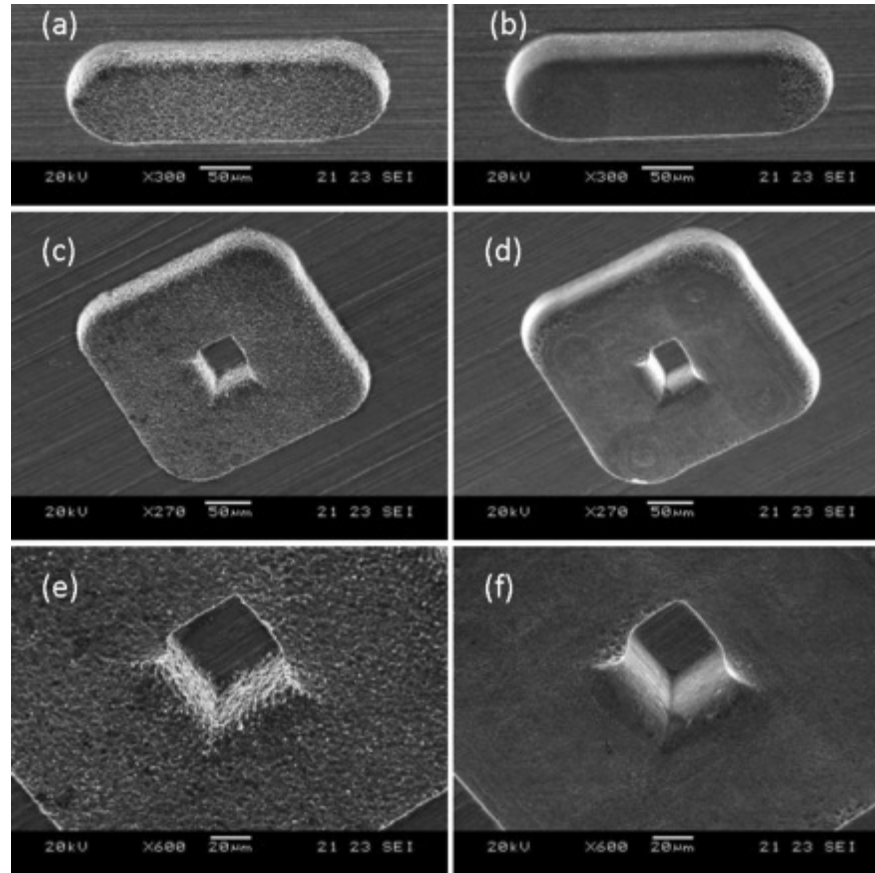
(a) 500 kHz voltage pulses and (b) continuous voltage.

- Layer depth – smaller layer depth preferred



(a) 0.5 μm and (b) 1 μm

Fabricating Different Shapes



micro-ED milling
f = 50 µm/s

SEDCM milling
f = 10 µm/s

Better Surface Finish

micro-ED milling
 $f = 50 \mu\text{m/s}$

SEDCM milling
 $f = 10 \mu\text{m/s}$

