

Laser writing for selective copper seeding on polymers

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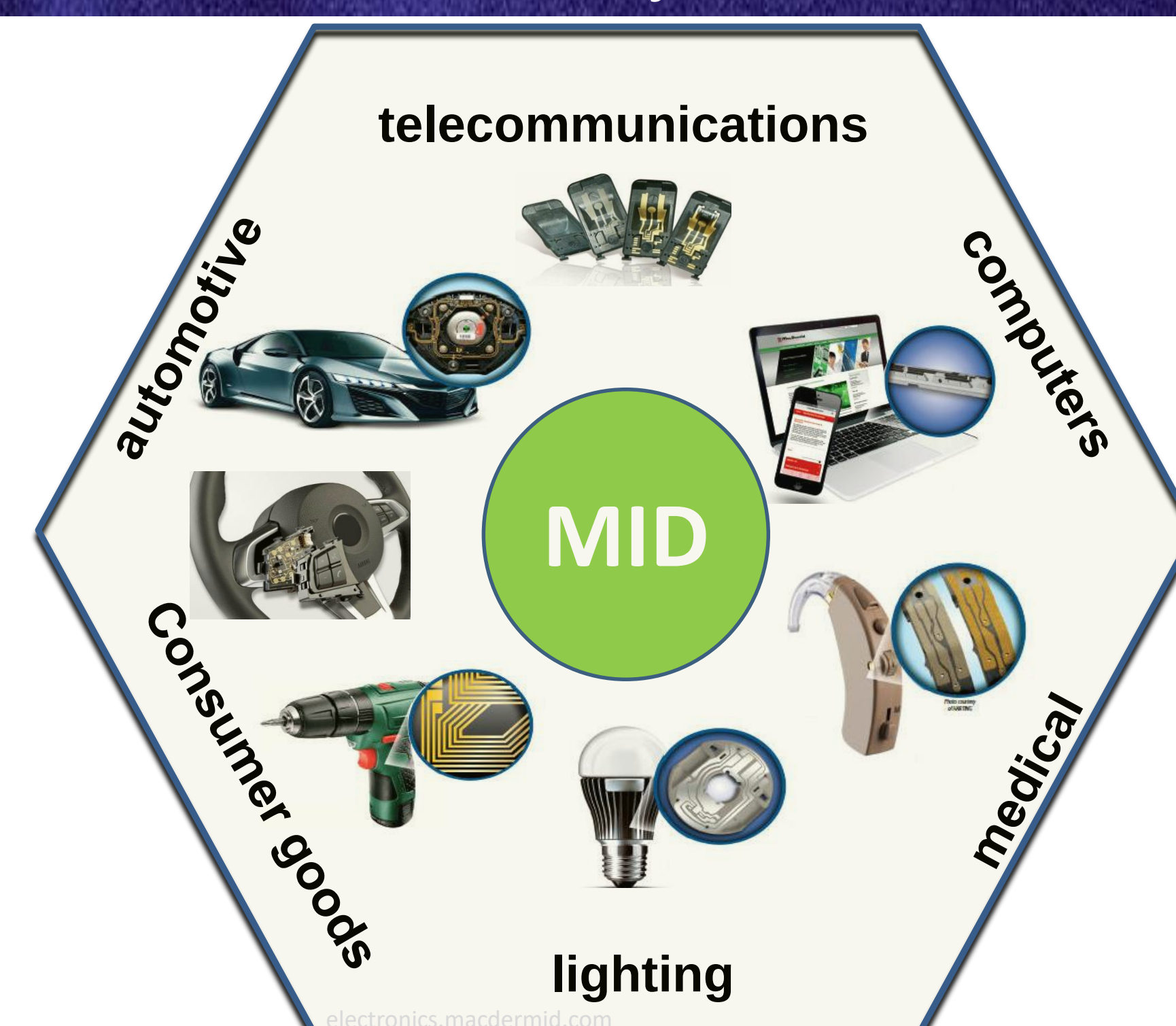
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Fabrication of circuit traces is the most challenging task in the molded interconnection device (MID) technology. The technical difficulties which can be met when producing conductive trace are spatial selectiveness and adhesion of a plated metal. On the other hand, the technique used to manufacture circuit should be cost-effective as well. Considering this background, two methods of selective plating induced by a laser are presented here: laser direct structuring (LDS) approach for the plastics with carbon nanotubes additives and the a new technology for MID – selective surface activation induced by laser (SSAIL). This new technique for selective surface plating enables to use standard plastics without any LDS additives. In both cases, metal deposition was performed by electroless plating. Nanosecond and picosecond lasers are applied for polymer surface treatment. The plastic material used in experiments were PP, PC/ABS, PA, PVC.



Laser direct structuring using CNT

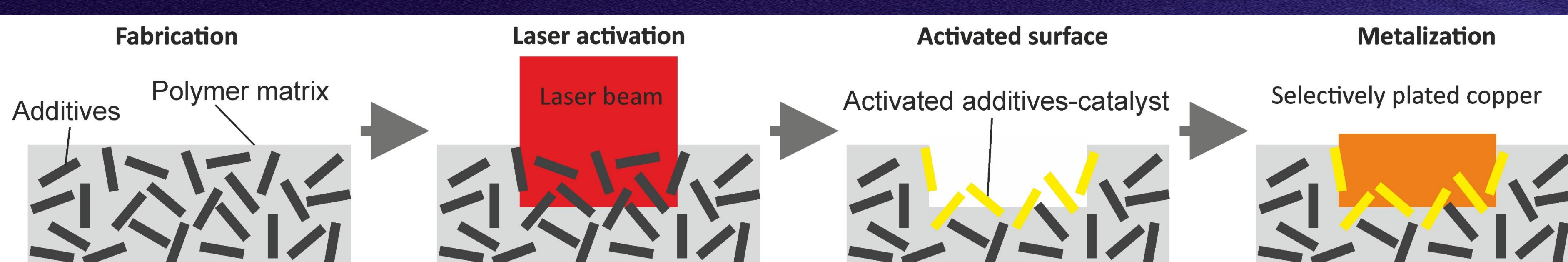


Fig. 1 Diagram of LDS process

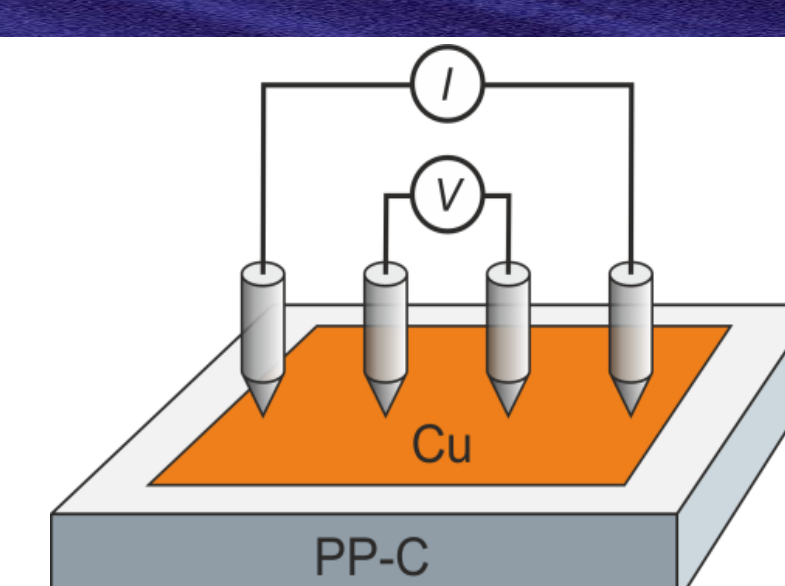


Fig. 2 Scheme of sheet resistance measurement

Concentration of additives	5 %		2,5 %	
Laser treatment	yes	no	yes	no
Sheet Resistance	1.65e5	2.3e7	1.66e5	2.3e7

Fig. 3 Sheet resistance of no plated surface

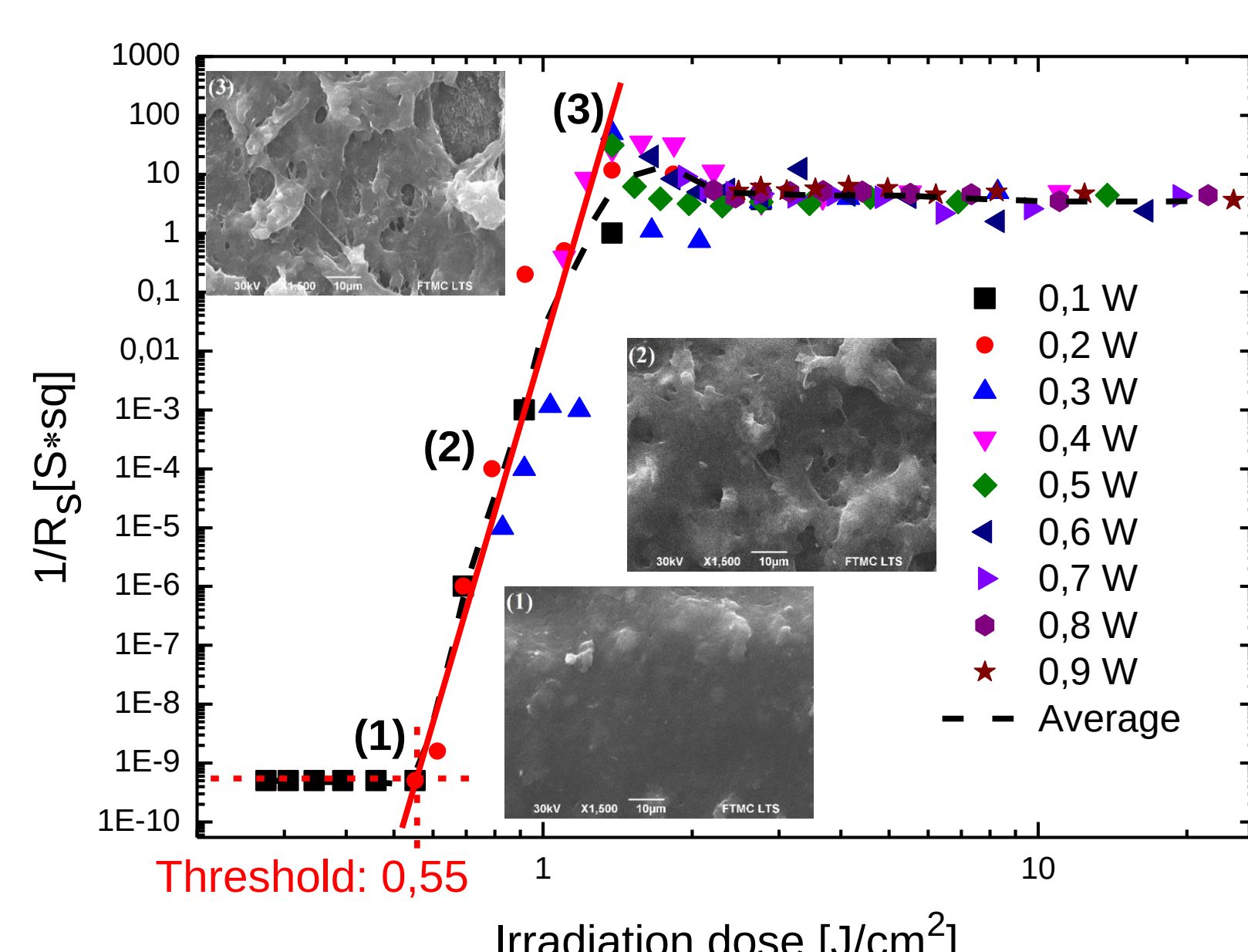


Fig. 4 Plated surface conductivity dependence on the irradiation dose

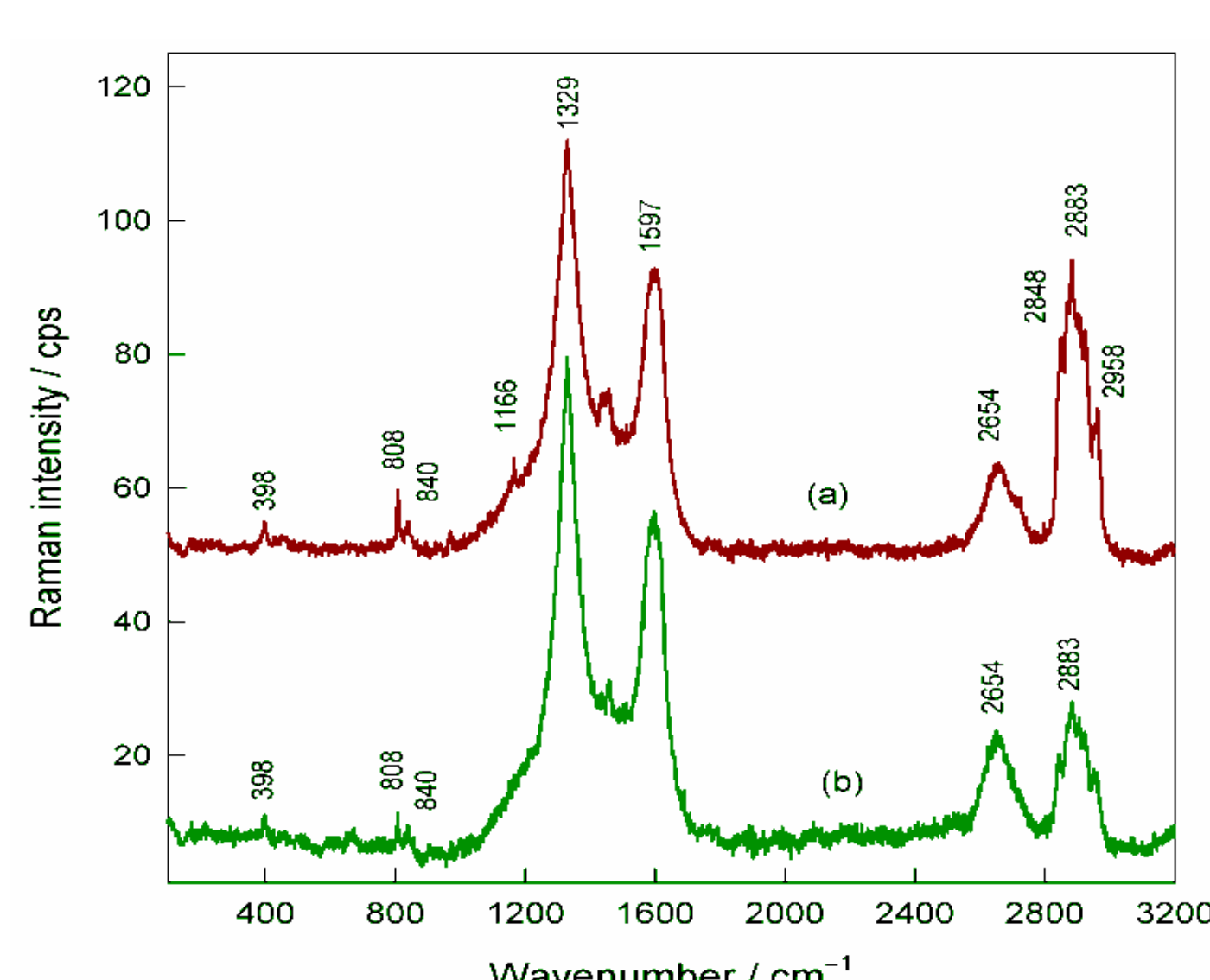


Fig. 5 Raman spectra of PP: (a) before, and (b) after laser treatment

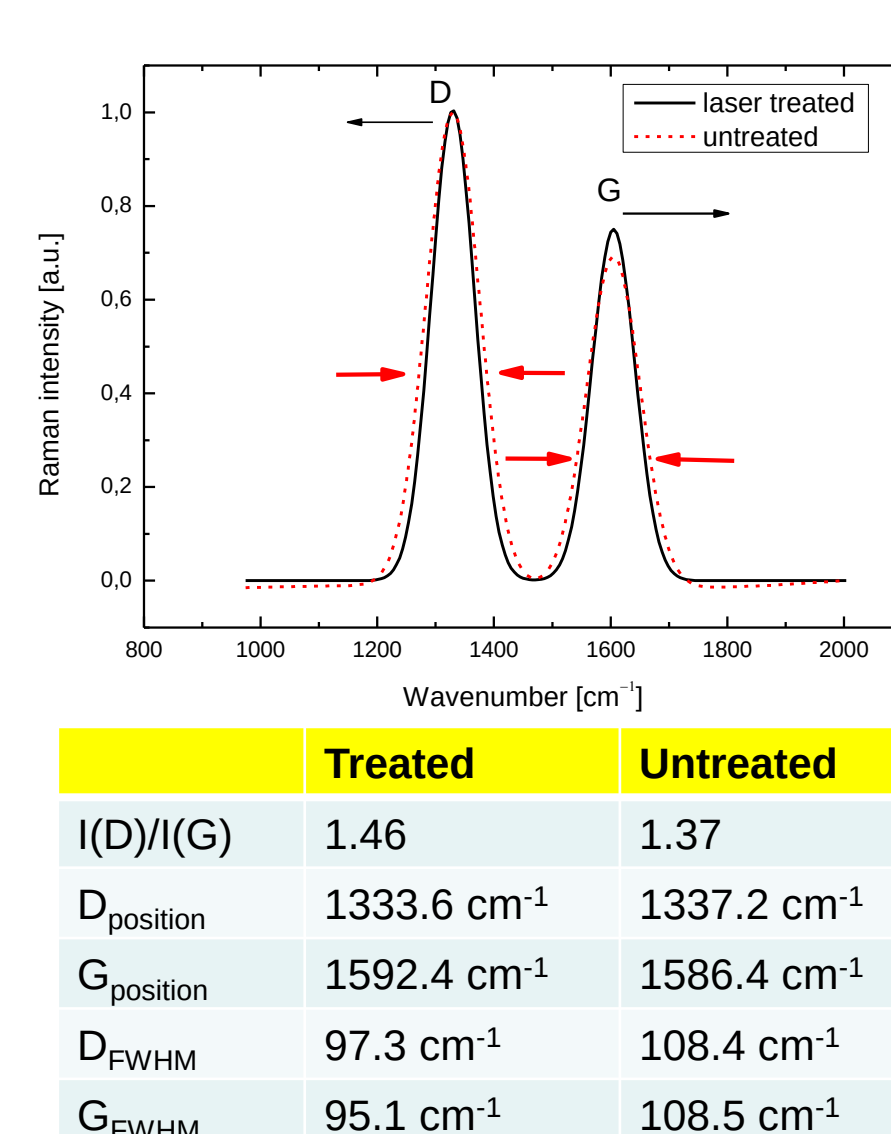


Fig. 6 D and G bands in Raman spectra of PP (with CNT additives)

Results

- Activation – melting (works only with ns pulses)
- Raman - growth of crystalline clusters and nanocrystalline disordered structure formation
- Decrease of surface resistivity after activation
- Laser writing speed up to 4 m/s

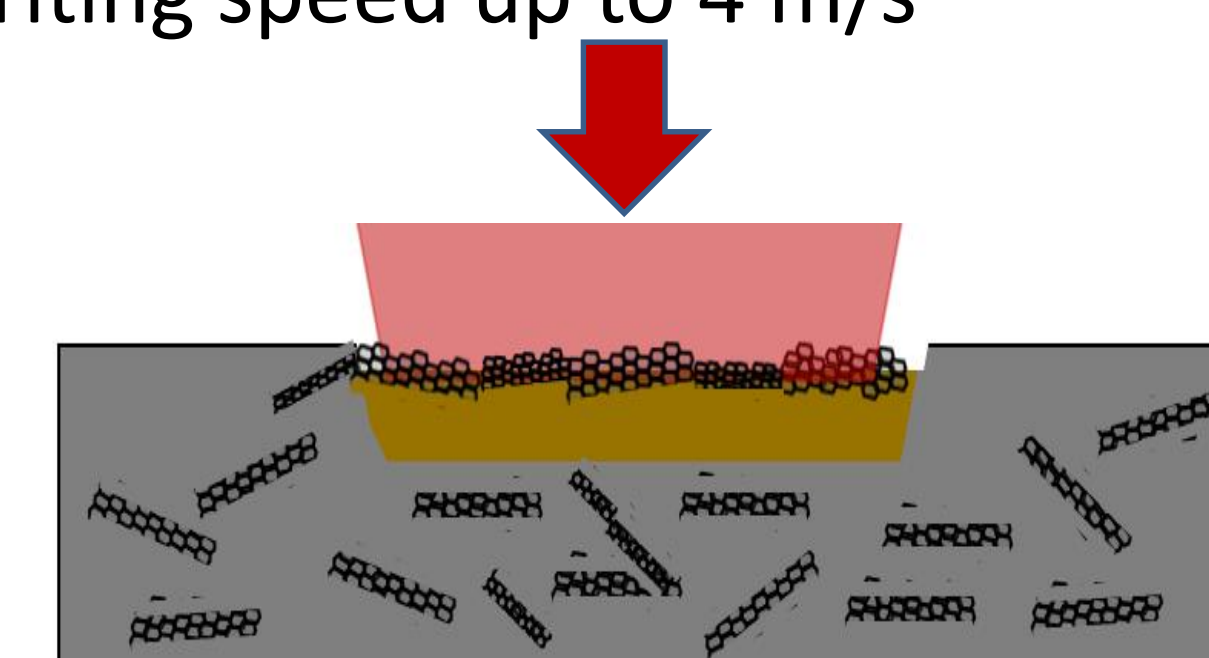


Fig. 7 Activation mechanism

Selective surface activation induced by a laser

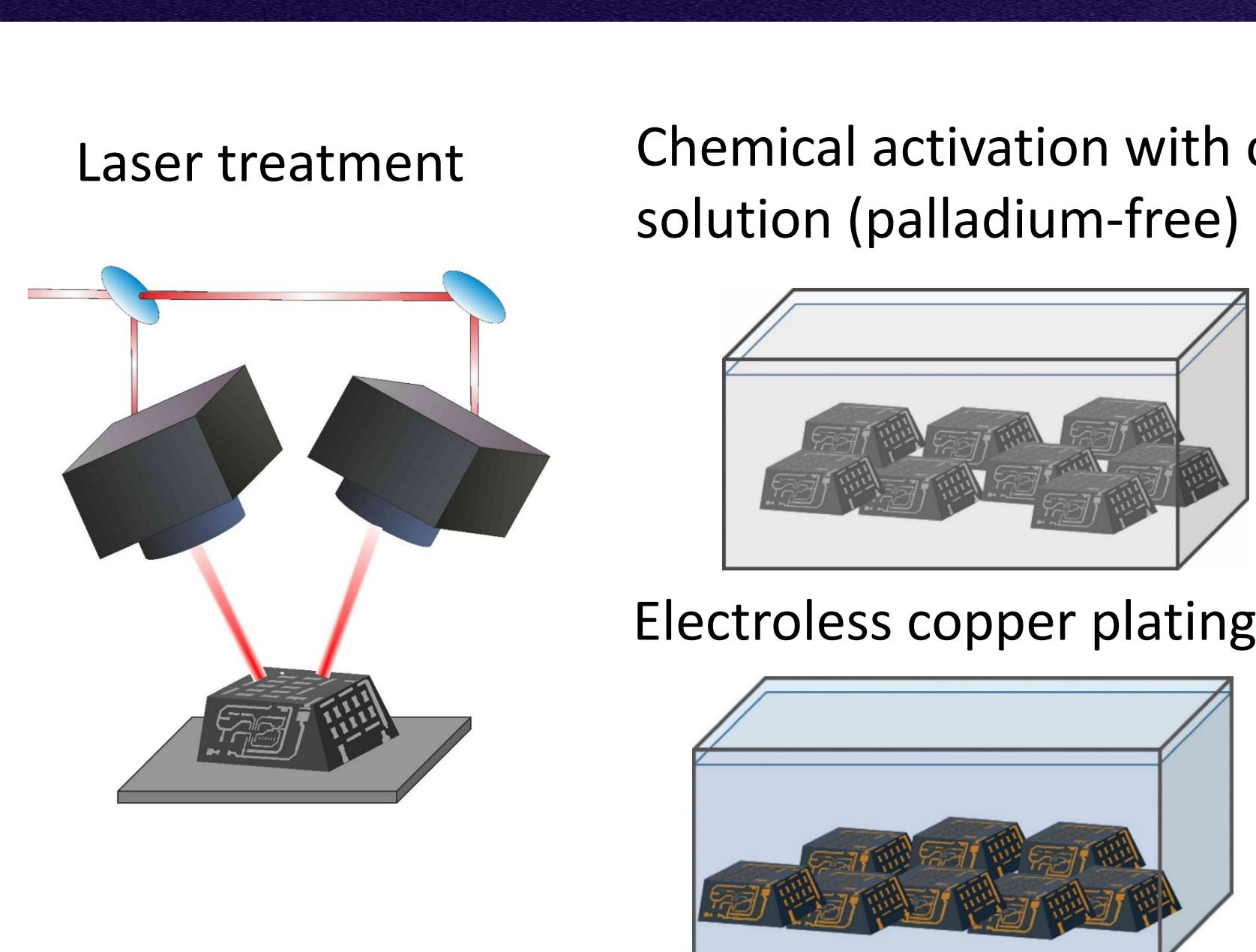


Fig. 8 Process steps of SSAIL method

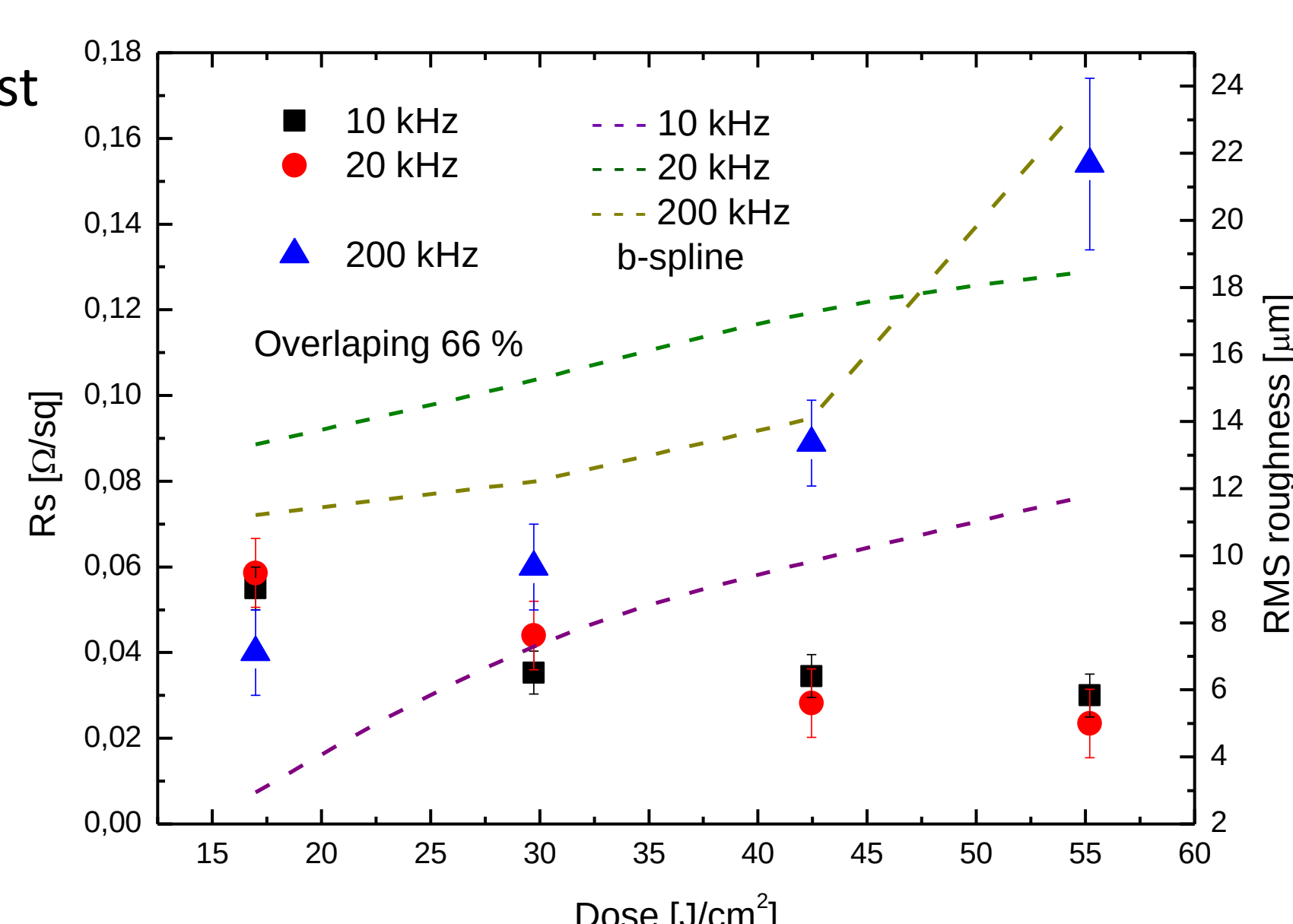


Fig. 9 Plated surface sheet resistance and roughness dependence on the irradiation dose

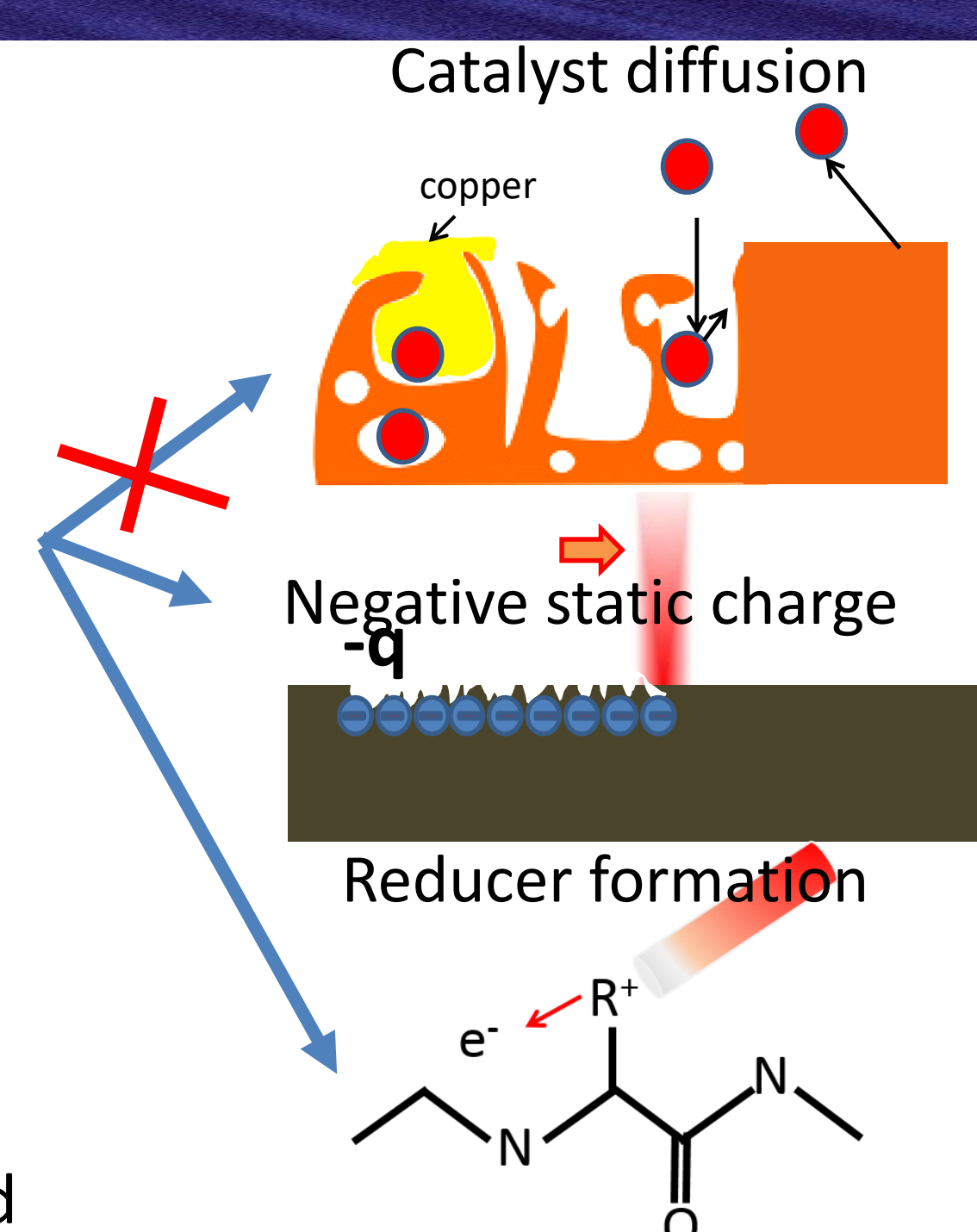


Fig. 10 Activation mechanism

Results

- Activation –works only with ps pulses
- Depends on the irradiation dose
- Does not correlate with surface roughness
- Plating pitch 25 μm
- Laser writing speed up to 4 m/s

Demonstrators produced using SSAIL technology

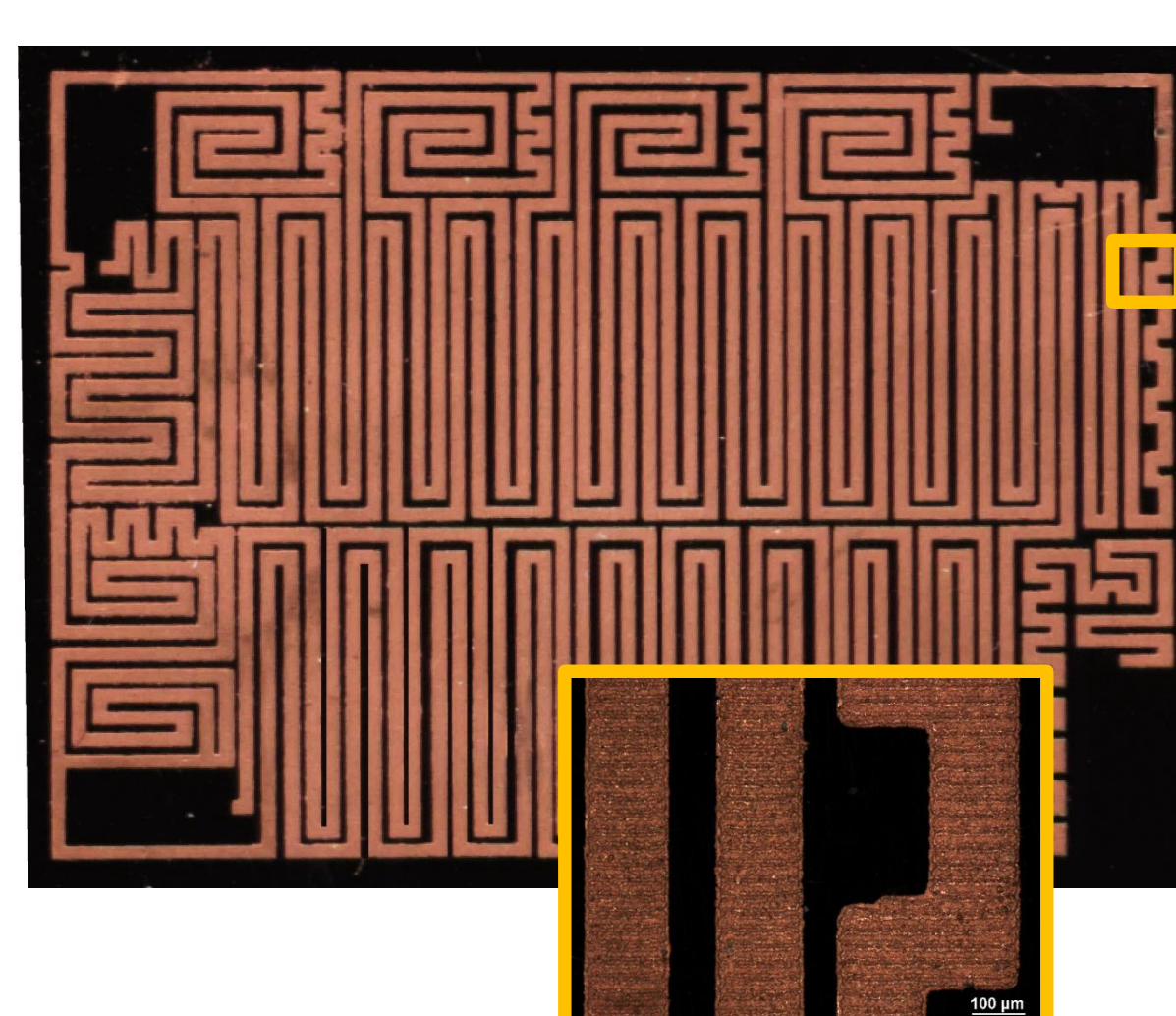


Fig. 11 Circuit for security applications. High spatial selectiveness

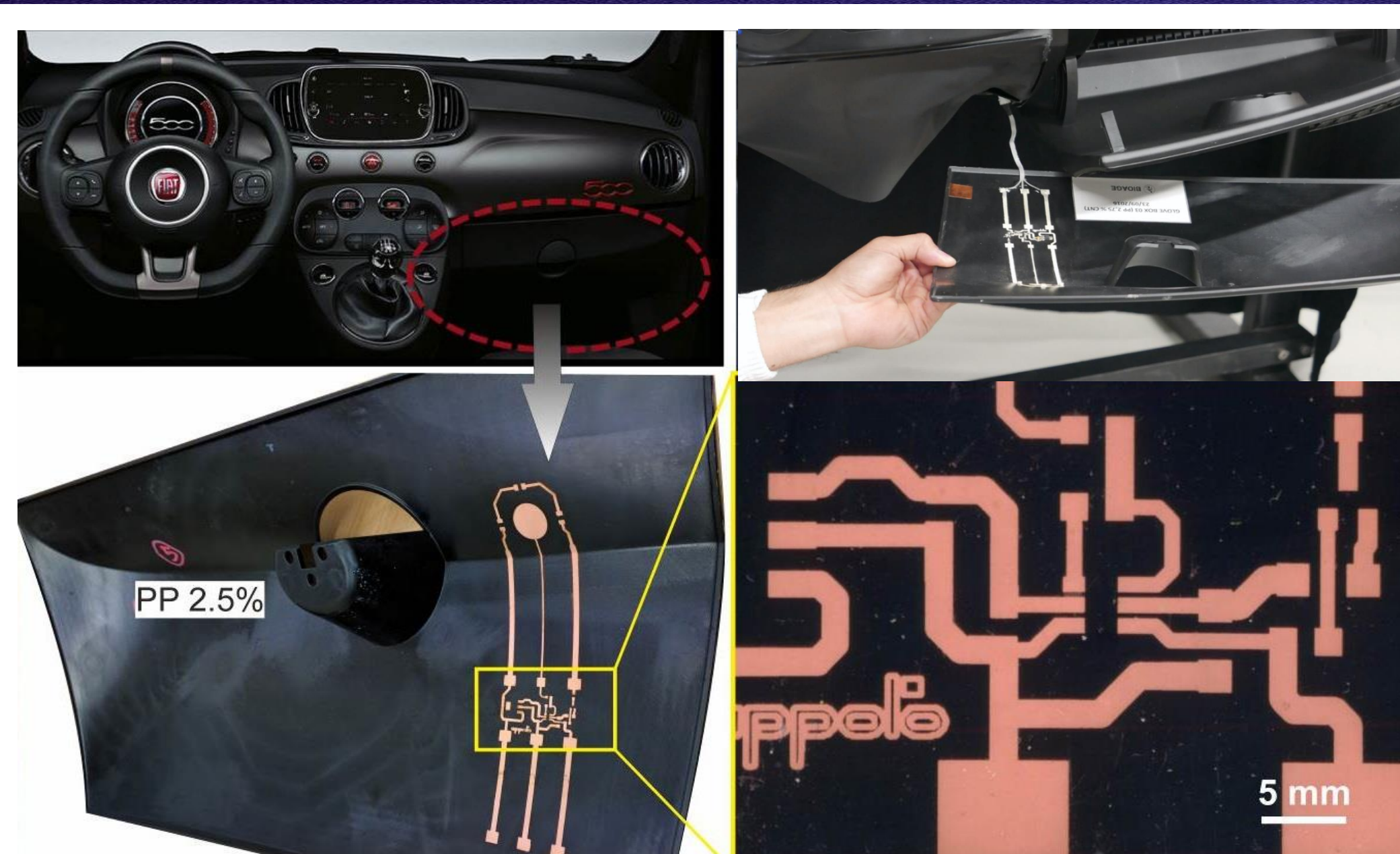


Fig. 12 Fiat 500 circuit of sensitive touch button for opening glove box cover. Installed in automobile

