

Article

# Directed Irradiation Synthesis as an Advanced Plasma Technology for Surface Modification to Activate Porous and “as-received” Titanium Surfaces

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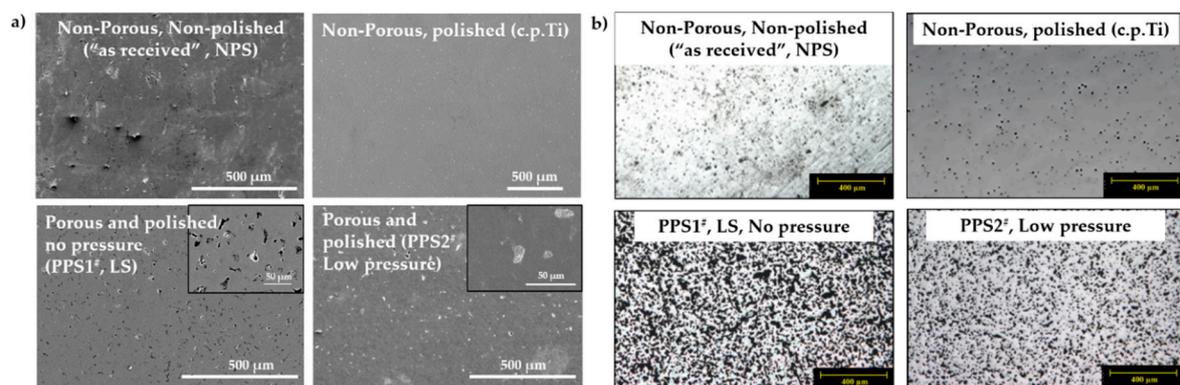
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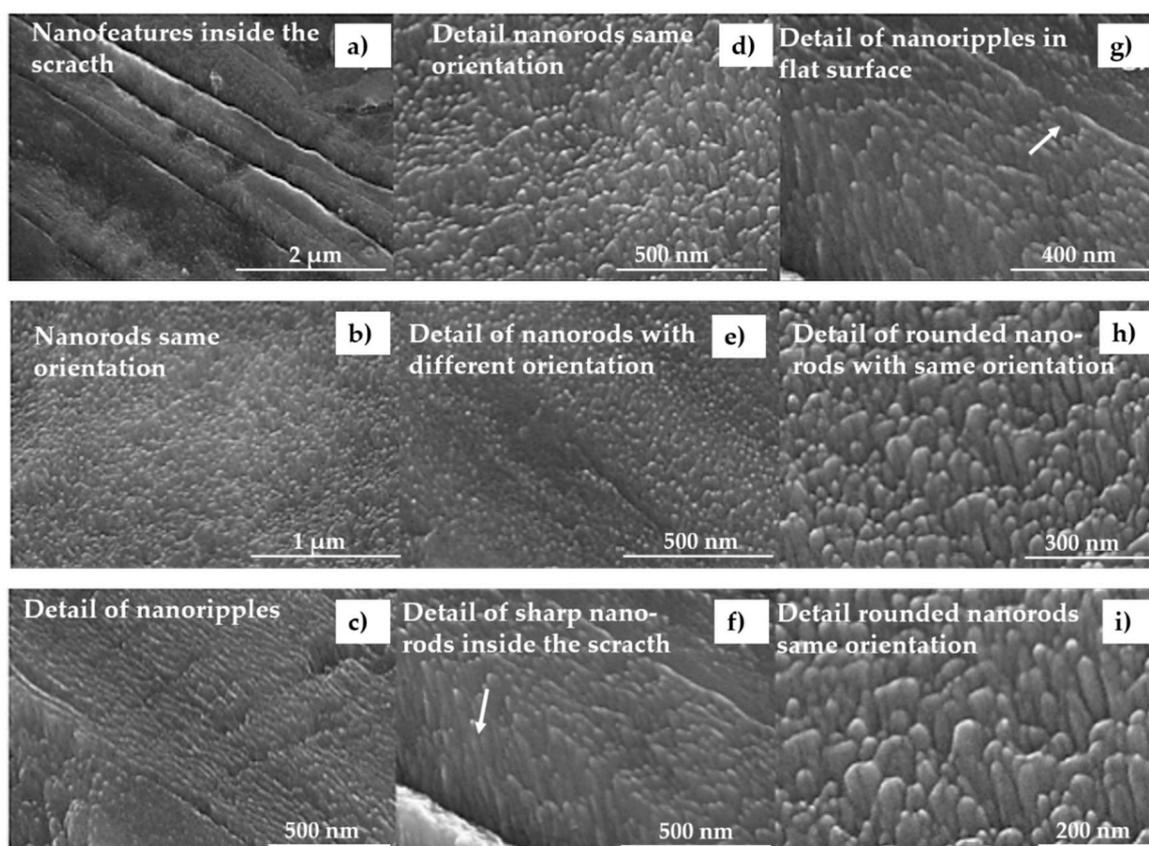


**Figure S1.** Evaluation of the different surface finishing of c.p. Ti samples before DIS modification. (a) SEM images of “as received”, c.p.Ti, PPS1# and PPS2# substrates respectively. (b) Optical microscopy images performed with a Nikon Epiphot (Nikon, Tokyo, Japan) coupled with a camera Jenoptik Progres C3 (Jenoptik, Jena, Germany) before DIS treatment.

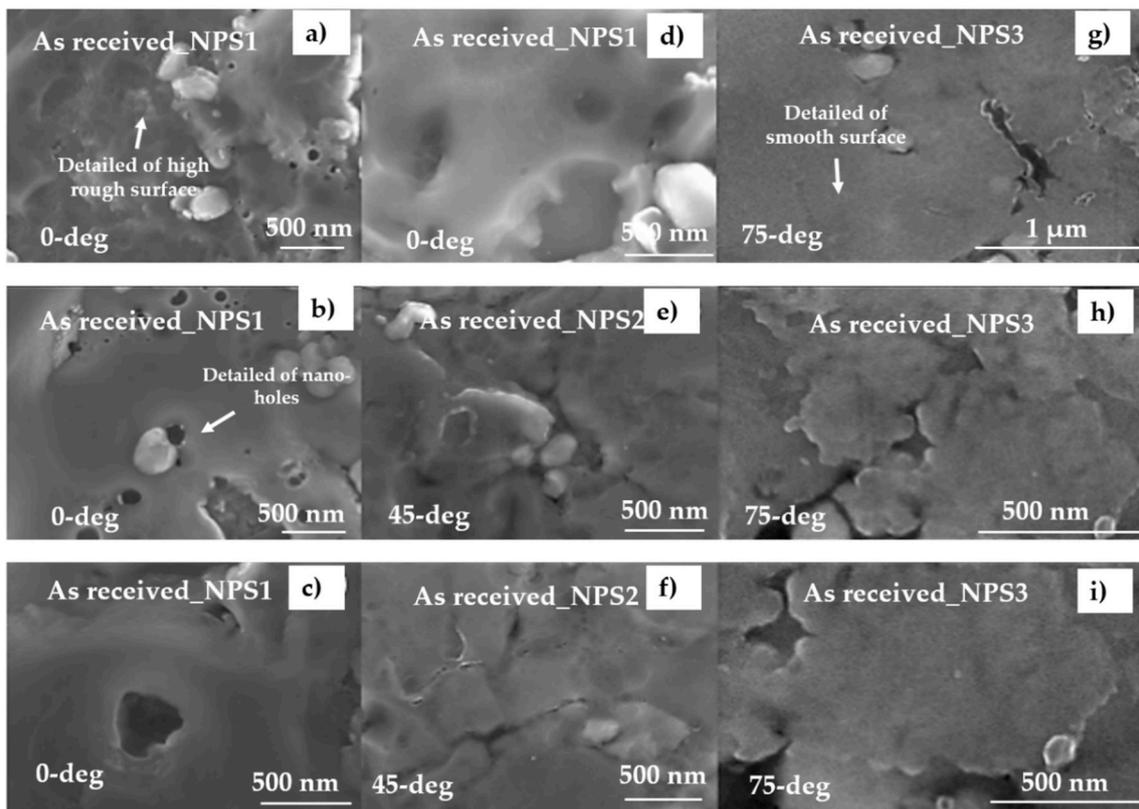
## Polishing protocol to achieved same surface finishing between c.p.Ti, PPS1#, and PPS2# substrates

In our group, the polishing treatment has been updated based on several studies and guidelines (ATSM and ISO rules) to achieve a detail and smooth surface finishing. In short, our process begins

with 240 sandpaper, using STRUERS polishing machine to rough down, under continues low flux of water and 50-70 rpm of rate. This step should be performed till have the entire surface covered by lines in the same direction and kind of shade (time of this step between 10-15 mins). Later, we replicate this process with the following sandpapers 600, 1200, 2500 and 4000 under same conditions, pressing homogenously the whole sample. At the end, the surface should appear shade without lines, scratches and very smooth surface. Subsequently, a mechanochemical polishing using STRUERS polishing machine and MD CHEN (black sandpaper) is developed. A mixture of colloidal silica (OP-S) and Hydrogen peroxide (30%) is used during 15-25 mins. After testing the final surface under microscope, to check the absence of rough down lines, we perform several washing steps in ultrasounds bath with water and soap, water and finally with ethanol under the polished side. At this point, we obtain a surface like a mirror for all samples and without closed pores.



**Figure S2.** SEM images of different areas of porous and polished c.p. Ti surface (PPS2) after the irradiation of Argon ions by DIS. White arrows indicate the presence of nanocolumns or nanorods (f) and nanowalls in the same area (g).



**Figure S3.** SEM images of different areas of non-porous as received surfaces after the irradiation of Argon ions by DIS using different incidence angles. (a) to (d) images correspond to NPS1, (e) and (f) represent NPS2, and NPS3 are (g) to (i) images. The white arrows point out the detail of rough surface in (a), nanoholes in (b) and smoother substrate in (g).

