

Direct Laser Patterning of Self Assembled Monolayers on Cobalt Chromium (Co-Cr) Alloy

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Cobalt Chromium (Co-Cr) alloy has been extensively used for a wide variety of applications in orthopedic, cardiovascular and dentistry [1]. Successful surface modification of Co-Cr surfaces is needed to tailor its surface properties for specific applications [2]. Direct laser patterning offers significant advantages as it eliminates the need for photolithography directly or indirectly. (the desired pattern can be formed by the relative movement of the laser beam and the sample) [3]. It is a non-contact, flexible method where last minute changes could be incorporated in desired patterns without difficulty and high costs [3].

In this work we have demonstrated the formation of surface patterns on self-assembled monolayers (SAMs) on Co-Cr alloy using direct laser patterning. Octadecylphosphonic acid (ODPA) organic thin films (Figure 1) were formed on Co-Cr alloy via solution deposition techniques [4]. Previous work from our group has extensively characterized formation of SAMs on Co-Cr surfaces [5]. Direct laser surface patterning was used to create surface patterns by laser etching of the SAMs covered Co-Cr surfaces. Figure 2 shows the schematic representation of the direct laser patterning setup. A titanium sapphire femtosecond pulsed laser was used for the direct laser etching.

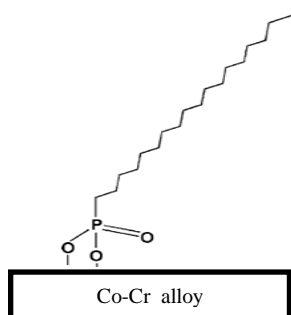


Figure 1: Schematic representation of SAMs Co-Cr alloy

Figure 3 shows the 3D AFM view for the direct laser etched SAM surface on Co-Cr alloy. The laser etched region can be clearly seen by the dark hollow spot as seen in the image. The Gaussian beam width of the laser was determined to be 10 μm . Analyzing the etched area we see the diameter of the etch to be approximately 12 μm . This suggests a certain degree of heat transfer from laser irradiance to the surrounding areas which may induce a certain amount of photo-thermal decomposition of the SAMs which would explain the deviation of the diameter of the etch from 10 μm to 12 μm . The results however demonstrate the successful direct laser patterning of self-

assembled monolayers on Co-Cr alloy.

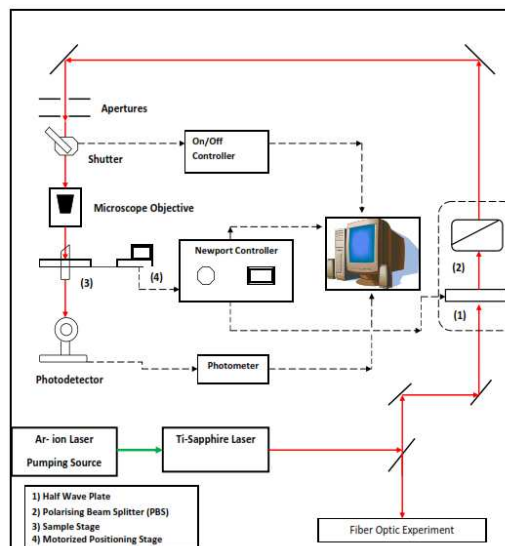


Figure 2: Schematic representation of direct laser patterning setup

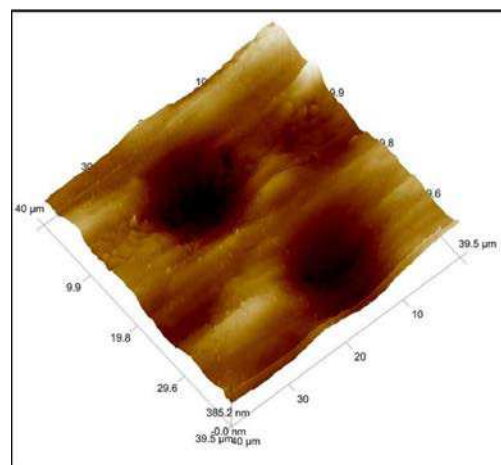


Figure 3: 3D AFM view for direct laser etched SAM surface on Co-Cr alloy

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