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Preparation of thermo-sensitive poly(N-isopropylacrylamide) film using KHz alternating current pulsed discharge

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Dielectric barrier discharge (DBD) is an effective way of producing homogeneous plasma. Plasma, a quasi-neutral gas, is referred to as the fourth state of matter. Plasma surface treatment consists of plasma surface modification, plasma polymerization and plasma surface grafting. It is very applicable to modern continuous mass production of industry, and has a very broad prospect. Dielectric barrier discharge consists of infinite microdischarges, which distribute irregularly the whole discharge space both in time and in space. Homogeneous dielectric barrier discharge looks like the glow discharge in vacuum and is very necessary to the surface modification of some special materials. And it has become one focus of plasma physics. The paper explains the mechanism of dielectric barrier discharge and favorable conditions for homogeneous DBD discharge using KHz alternating current pulsed discharge. The self-made equipment of atmospheric pressure plasma vapor deposition of poly (N-isopropylacrylamide) (PNIPAm) was used in the environment of argon and the suitable discharge gap. PNIPAm is a new type of smart thermo-sensitive macromolecule material that is characterized by a sudden precipitation on heating, switching from a hydrophilic to a hydrophobic state. The samples were characterized by scanning electron microscopy (SEM), x-ray photoelectron spectroscopy (XPS) and water contact angle. It was revealed from the results of SEM analysis that the poly PNIPAm coatings were formed on the surface of the smooth glass slides, according to XPS, it was found that there exists PNIPAm and the wettability was significantly modified by changing the temperature above and below the lower critical solution temperature (LCST) from the data of the water contact angle test.

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