PL-I-3

PAPER HYDROPHILIC SURFACE PROPERTIES IMPROVEMENT BY COLD PLASMA-ACRILIC ACID TREATMENT.

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The hydrophilic properties of paper play an important roll, as the end uses of many products require to be absorbent of liquids. The superabsorbent materials are cross linked polymeric network flexible chains with disociated ionic functional groups, as polyacrylamide, polyvinyl alcohol, and Polyacrilic Acid[1]. The later one is one of the most widely superabsorbent material used , partialy neutralized and cross linked. Polyacrilic acid (PAA) thin layers were created on CTMP sisal paper surface by using Acrilic acid (AA) RF-Plasma conditions. Low pressure plasma functionalization experiments were carried out in a cylindrical, glass-rotating reactor, using a 13.56 MHz RF plasma source. A three factorial experimental design was employed to carry out a post plasma aided surface modification experiments. The RF-power, Argon working pressure, Argon treatment time, AA-presure, and AA Treatment time were the used variables. Post plasma-AA modified samples were characterized by a novel water absorption procedure. The water absorption capacity for the treated paper has the highest value for an argon working pressure of 200 mtorr, AA-pressure of 100 mtorr, RF-power of 100 watts, argon treatment time 0.2 min, and AA post plasma treatment time of 8 min. The relative surface atomic composition for untreated and post plasma AA treated samples and the relative ratios of C_{1s}, and O_{1s} surface functionalities were evaluated using survey and high resolution X-ray photoelectron Spectroscopy (ESCA). Plasma induced surface morphology changes of plasma and post AA treatment, were evaluated by Atomic Force Microscopy (AFM), and Scanning Electron Microscopy (SEM). By the water absorption procedure, it was found that water absorption capacity for untreated paper was 3.7 gr of water/gr of paper and for the surface AA post plasma treated paper was 5.4 gr water/gr of paper. The strength properties of paper samples were not affected at all, and the brightness of paper was increased a 4.15%. The ESCA analysis (Fig. 1) reveled a paper surface with an increase in a 286% for C_4 band or C(=O)OH bonds at 282.9 eV^2, which means that some poly AA was graffted on the surface of paper. The AFM (Fig. 2) and SEM images (Fig. 3) of modified samples show that the paper exposed to post plasma AA treatment during 8 minutes, are covered by a rougher surface formed by granules. This work opens up new ways for the production of high absorbency papers for special uses, like for instance, waterblocking tape for optical communication cables and so on.

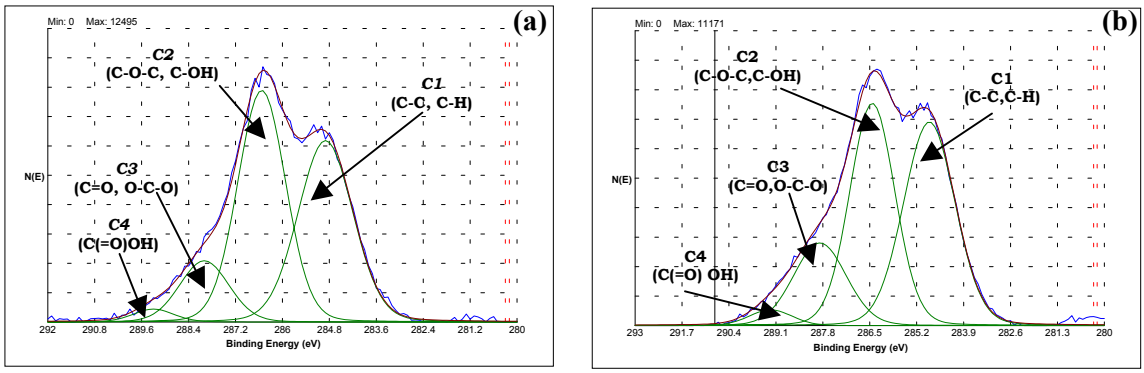

Fig 1. High resolution ESCA Spectra for: (a) Unbleached-Untreated CTMP paper, and (b) Unbleached –Argon plasma and post plasma-AA modified CTMP paper.

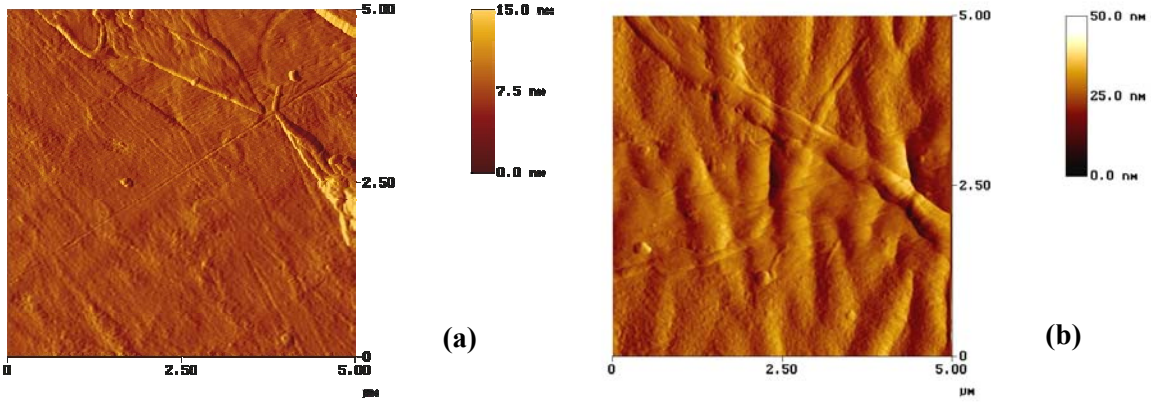

Fig. 2 AFM images of unbleached CTMP paper, 5μm: (a) plasma untreated, and (b) Argon plasma treated and post plasma-AA treatment.

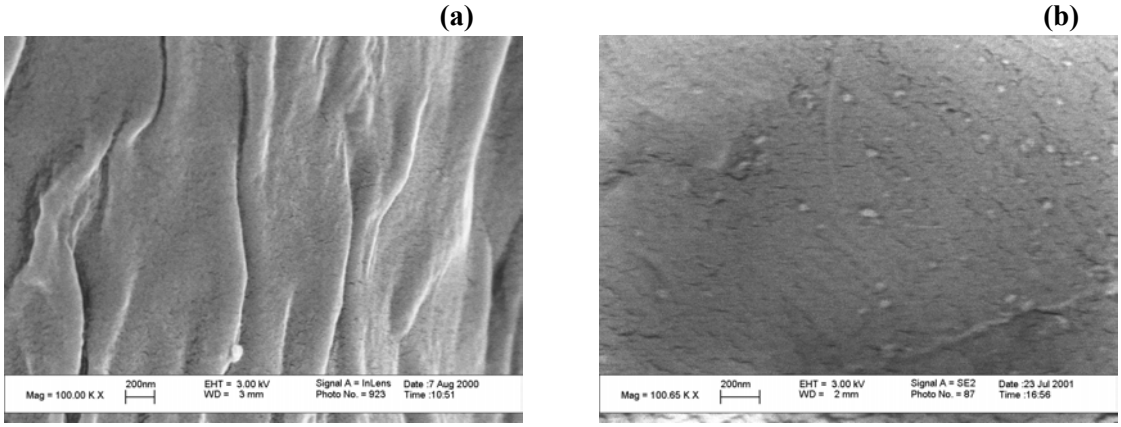

Fig. 3 SEM photographs of unbleached CTMP paper, 100,000X≅3μm: (a) plasma untreated paper, and (b) Argon plasma treated and post plasma-AA treatment.

References

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