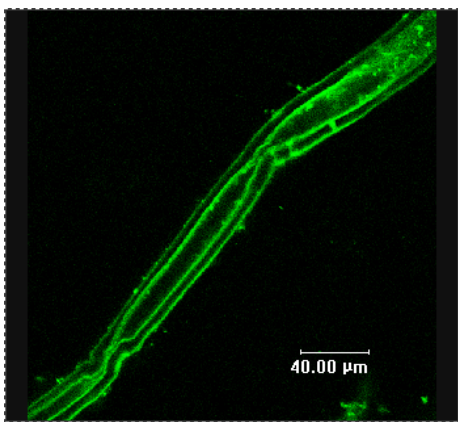


## Layer-by-Layer Nanocoating for Stronger Paper with Better Recycling

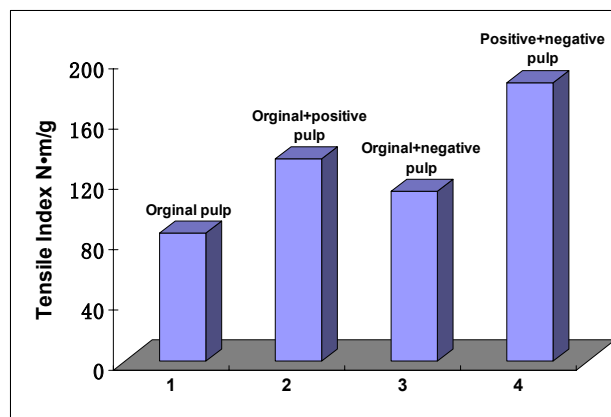
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The systematic modification of the surface charge of lignocellulose fibers was performed with a polyelectrolyte layer-by-layer (LbL) nanocoating process to produce negatively and positively charged fibers. The fibers were coated with 20-50 nm thick polymer surface layers, which subsequently increased interaction between the fibers during paper formation. The modified fibers were added to standard virgin pulp fibers at varying proportions to produce paper with corresponding variation in properties such as strength and electrical conductivity. Paper strength was doubled by manipulating the surface charge and coating thickness of the LbL-treated pulp fibers. It is demonstrated that the LbL coating process increased the fiber interactions and that these interactions enhanced the paper properties. This process, when applied to a simulated sample of recycle grade fibers (short broken fibers), produced paper with an increased strength as compared with untreated recycle grade fibers



**Fig. 1**



**Fig. 2**

**Fig. 1** Laser confocal fluorescent image of longitudinal cross-sections of softwood pulp fibers coated with 30-nm labeled (PAH-FITC/PSS)<sub>3</sub> multilayers. Both, the outside fiber surface and the lumen surface were coated with nano-electrolytes. PAH- poly(allylamine hydrochloride) and PSS – sodium poly(styrene sulfonate).

**Fig. 2** Tensile strength test results (TAPPI T494-014-88 standard) of handsheets made from LbL-coated fibers of (PAH/PSS)<sub>3,3.5</sub> compositions and their mixtures with untreated pulp fibers. The strongest sample with tensile index of 180 N m/g consists of 1:1 mixture of LbL-treated positive and negative fibers.