NANOCELLULOSE BASED PIEZOELECTRIC SENSORS

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Cellulose based nanomaterials, generally known as nanocellulose [1], are interesting renewable bio-based nanomaterials which have potential applications in material sciences, electronics and biomedical engineering and diagnostic. A strong ability to form lightweight, highly porous, entangled networks makes nanocellulose suitable substrate or membrane material for various applications, such as supercapacitors [2, 3].

It was proposed already in 1950's, that wood has piezoelectric properties initiating from the highly crystalline assemblies of cellulose chains [4]. Experimental evidence of the piezoelectricity of cellulose nanocrystals (CNC) was reported only very recently [5, 6]. Cellulose nanofibrils (CNF), produced by a mechanical homogenizing process from cellulose fibers, contain both crystalline and amorphous regions. CNC can be obtained from CNF by removal of amorphous regions using hydrolysis e.g. in sulfuric acid.

Here, we report the experimental results on piezoelectricity of nanocellulose films prepared using different methods. The piezoelectric sensitivity of prepared sensor elements is measured using in-house built measurement setup equipped with a mechanical shaker and charge amplifier [7]. A randomly oriented CNF film (prepared by pressure filtering from aqueous CNF dispersion) showed piezoelectric sensitivities of 2-7 pC/N [8, 9], which is between the piezoelectric coefficients of quartz (2.3 pC/N) and polyvinylidenefluoride (PVDF, -30 pC/N). Initial results from the nanocellulose based composite films gives promises for biomedical applications of nanocellulose based piezoelectric sensors.

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