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Nanostructured materials are difficult to prepare rapidly and at large scale. Melt-processed polymer-clay nanocomposites are an exception, but the clay content is typically below 5 wt%. An approach for manufacturing of microfibrillated cellulose (MFC)/kaolinite nanocomposites is here demonstrated in pilot-scale by continuous production of hybrid nanopaper structures with thickness of around 100 μm. The colloidal nature of MFC suspensions disintegrated from chemical wood fiber pulp offers the possibility to add kaolinite clay platelet particles of nanoscale thickness. For initial lab scale optimization purposes, nanocomposite processing (dewatering, small particle retention etc) and characterization (mechanical properties, density etc) were investigated using a sheet former (Rapid Köthen). This was followed by a continuous fabrication of composite paper structures using a pilot-scale web former. Nanocomposite morphology was assessed by scanning electron microscopy (SEM). Mechanical properties were measured in uniaxial tension. The fire retardancy was evaluated by cone calorimetry. Inorganic hybrid composites with high content of in-plane oriented nanocellulose, nanoclay and wood fibers were successfully produced at pilot scale. Potential applications include fire retardant paperboard for semi structural applications and as reinforcement mats in molded thermoset biocomposites.

1. Introduction

Cellulosic nanomaterials are a new category of industrially available forest products. Applications of nanocellulose have been suggested in a variety of technological areas [1–4].