In this study we synthesized an advanced and external stimuli multiresponsiveness aqueous nanofluid based on modified cellulose nanocrystals (CNC). The CNC were obtained by acid hydrolysis of cotton linters. This hydrolysis reaction impart sulfate ester groups on CNC surfaces that are responsible for their colloidal stability. The CNC were modified by physical chemical reactions: oxidation mediated by TEMPO/NaClO/NaBr and peptidic coupling reaction with thermosensitive polyetheramine (click chemistry). The MXX®-CNC suspensions present improved colloidal stability in polar and non-polar media. This can be explained due to changes of electrostatic stabilization towards electrostatic and sterical stabilization imparted by the thermosensitive polyetheramine grafted on oxidized CNC. The MXX®-CNC suspensions also showed tunable and increased rheological properties at high temperature and high salt concentration. Additionally, this very promising system present ecological and economical concern to prepare nanofluids at large scale for advanced industrial applications as drilling, coolant, lubricant and displacement nanofluids.