Dynamic mechanical analysis (1–30 Hz, 274–414 K) is employed to study the inter- and intramolecular dynamics in a set of PMMA-CELL blends. Two relaxation processes are observed, the dynamic glass transition (a-relaxation) being characterized by WLF law and secondary transition (b-relaxation). The a-relaxation is strongly influenced by the composition of the blends and shows a rapid slowing down with increasing cellulose (CELL) intake. Increasing the content of the latter reduces the strength of the b-relaxation strongly and increases its activation energy by more than 60%. This proves that owing to the interactions between the cellulose hydroxyl group and PMMA ester group, the b-relaxation no longer has a local character only. By fitting the Tg data for the blends to Tg-composition models proposed by Gordon and Taylor and by Jenckel and Heusch, it is shown that the strength of the interaction increases strongly beyond 72% of CELL intake.