This experimental study focused on the surface characterization and boronizing kinetics of a micro-alloyed carbon steel. The boronizing treatment was carried at 1123 K under various exposure times (3, 5, 7 and 9 hours), using Ekabor-II powder. A bilayer configuration consisting of FeB and Fe2B was produced. The generated boride layers were characterized by the following experimental techniques: SEM coupled to EDS, XRD and GDOES analysis. The growth kinetics of the boride layers was also analyzed. In addition, an iso-thickness diagram relating the total boride layer thickness to the process time was established.