**Highlights**

* Granular Cr, Mo, and Cr-Mo active basic flux were manufactured by the unfused-bonded method.
* SAW was employed successfully on ST37 steel by bead on plate technique and active fluxes.
* Acicular ferrite formed by the assist of nonmetallic inclusion during welding, which improved mechanical properties, extremely.
* The inclusions characteristics and alloying elements transferred from flux into weld metal and slag also measured.