Welding

Recent Research activities:
The laser-gas metal arc hybrid welding process offers the potential for high productivity welding of a range of materials and applications, including pipeline root applications. We have studied the influence of shielding gas on weld bead formation and geometry.

Figure 1 Macrographs of hybrid welds made using shielding gas mixtures containing: (a) 2 % O₂ + 20 % CO₂, (b) 20 % CO₂, (c) 7.5 % CO₂ and (d) 2.5 % CO₂ (vol. %, balance Ar).

Figure 2 Through thickness hardness distribution of welds produced using: (a) 2 % O₂ + 20 % CO₂, (b) 20 % CO₂, (c) 7.5 % CO₂ and (d) 2.5 % CO₂ (vol. %, balance Ar).

The study revealed that the microstructure and hardness are substantially influenced by the shielding gas composition when welding an API X-65 grade steel. The acicular ferrite volume fraction in the weld metal increased with CO₂ content up to 20 vol. %. A further addition of 2 vol. % of O₂ to the gas mixture significantly improved acicular ferrite volume fraction, lowering the maximum weld metal hardness and improving welding process stability, primarily due to the reduction of surface tension on the welding wire, resulting in more consistent metal droplet detachment.

Other Achievements:
[1] Editor in chief, Welding in the World