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Effect of travel angle on microstructure at heat affected zone of as welded carbon steel

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**Abstract:**

Metal inert gas (MIG) welding is an arc welding process that is used in many industrial fields. MIG welding is remarkable because of high penetration and quickness in producing welds process. However, MIG welding has some disadvantages including less stable arc, high spatter, and production of smoke and fumes in the process of welding. In this study, the four different travel angles (90, 75, 60 and 45) are used to investigate the effect of travel angle on the welding quality, microstructure formation at heat affected zone and the mechanical property. Pure argon is used as the shielding gas with constant current, voltage, and welding speed. The result shows that the lower travel angle produces higher penetration depth and reinforcement. However, lower travel angle produces more porosity compared to higher travel angle. The use of lower transfer/travel angle during MIG welding contributes to the deep penetration, high reinforcement of the weld bead and produce more porosity especially when the travel angle is set at 45. The microstructure observation shows that the formation of martensite and bainite are dominant in heat affected zone of the weldment prepared by lower travel angle. This result is in line with the Charpy impact test result where the toughness of the specimen prepared by lower travel angle shows the lowest toughness. As a consequence of the formation of more fraction of martensite at HAZ, the toughness of the specimen shows the lowest value travel angle at 45.