

## Technical Note Performance of Galvanized Steel Welding; Local Welders in Zaria, Nigeria

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**Abstract:** A lot of local welders in Zaria, Kaduna state, Nigeria uses an electric arc welding and Titania Potassium electrode for welding galvanized steel pipe which affect the welded material, as a result, the material encountered failure in terms of mechanical performance and corrosion resistance. Therefore, this paper examines the performance of galvanized steel welding and outlined the mistakes that usually encountered when High Titania Potassium Electrode (HTPE) is used in welding galvanized steel pipe. However, the factors associated with welding of galvanized steel were investigated, discussed and recommendation was adequately proffered.

**Key word:** Galvanized steel pipe, Electric arc welding machine and HTPE

### INTRODUCTION

An electric arc is formed when an electric current passes between two electrodes separated by a short distance from each other. In arc welding, one electrode is the welding rod or wire, while the other is the metal to be welded. The electrode and plate are connected to the supply, one to the positive pole and the other to negative pole. The arc started by momentarily touching the electrode on to the plate and then withdrawing it from the plate. When the electrode touches the plate, current flows, and as it is withdrawn from the plate, the current continues to flow in the form of a spark across the very small gap first formed<sup>[1]</sup>.

This welding process is by far the most widely used of the various electric – arc welding processes. Like the other electric – arc welding processes, it employs the heat of the electric arc to bring the work to be welded and a consumable electrode to a molten state. Arc welding with consumable electrodes is more widely practiced than welding with non-consumable electrodes. A consumable electrode is melted continuously by the arc, one pole of which is the electrode, the other pole being the metal to be welded<sup>[2]</sup>.

**Welding Electrode:** In arc welding an electrode is used to conduct current through a work piece to fuse two pieces together. Depending upon the process, the electrode is either consumable, in the case of Gas Metal Arc Welding or Shielded Metal Arc Welding or non-consumable, such as in Gas Tungsten Arc

Welding. For a direct current system, the weld rod or stick may be a cathode for a filling type weld or an anode for other welding processes. For alternating current arc welder, the welding electrode would not be considered an anode or cathode<sup>[3]</sup>.

### American Welding Society (AWS) Electrode Classification:

AWS Classification	Type of Covering
E60 series electrode	
E60 10	High Cellulose Sodium
E60 11	High Cellulose Potassium
E60 12	High Titania Sodium
E60 13	High Titania Potassium
E60 20	High Iron Oxide
E60 22 <sup>c</sup>	High Iron Oxide
E60 27	High Iron Oxide, Iron Powder Sourced from <sup>[1]</sup> .

Welding of galvanized steel is done almost exactly the same way as welding of bare steel of the same composition; the same welding processes, volts, amps, travel speed etc, can be used with little modification when the switch is made from uncoated steel to galvanized steel – unless the zinc coating is usually thick. The difference between welding galvanized steel and uncoated steel is a result of the low vaporization temperature of the zinc coated<sup>[4]</sup>. This paper examines the performance of galvanized steel welding among the local welder in Zaria, Nigeria.

**Galvanizing:** The generic term for any of several techniques for applying thin coatings of zinc to iron or steel stock or finished products to protect the ferrous base metal from corrossions; more specifically, the hot dipping that is widely practiced with mild steel sheet for garbage cans and corrugated sheets for roofing, sheathing, culverts, and iron pipes and with fencing wire. During dipping, molten zinc reacts with the steel to form brittle zinc – iron alloy. Control of temperature and the addition of aluminium reduce formation of the alloy, resulting in a more ductile coating<sup>[2]</sup>.

#### **MATERIALS AND METHODS**

**Materials:** The materials used for this research are mainly galvanized iron/sheet/pipe, electric arc welding machine and welding electrode (High Titania Potassium Electrode)

**Method:** The welding machine was set at a good position in which the electrode (high Titania potassium electrode) was also fixed on the electrode holder. The electrode was clamped between copper jaws which are spring loaded and simple to enables the electrode to be changed easily and quickly. The metal to be welded was set appropriately at good position before welding.

#### **RESULTS AND DISCUSSION**

After the Welding, the Following Were Observed:

- Formation of high slag from the electrode due to present of the zinc in the steel.
- After removing the slag, the surface of the welded area was poor and rough with some porosity presents. This observation is due to the present of zinc composition on the steel.
- Welding of galvanized steel consumed electrodes.
- During the welding, there is lot fumes produced which is dangerous to environment. Therefore, welding galvanized steel should always be done in well-ventilated locations to minimize fume inhalation.
- From this research, one of the disadvantages observed was that welding of the galvanized steel could not be done once but repeatedly. This was probably due to loss of electrode into the slag along with zinc layer.

**Conclusion:** From the results and observation in this paper, it is advisable to weld the uncoated steel pipe first before galvanizing. But if the steel is already coated with zinc (galvanized steel) then, the zinc should be remove before welding the needed area, then coat the welded area after (if possible). However, in welding galvanized steel, the use of ‘cover goggle’ as a protection for the welder against the fumes is encouraged.

Further recommendation from<sup>[5]</sup> suggest the use of Zr-Cr-Cu alloy for welding galvanized steel and other metallic coated steel.

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