

## DOUBLE WIRE GMAW: A CLOSER LOOK AT THE OUT-OF-PHASE PULSING

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### 1. INTRODUCTION

Double Wire GMAW is becoming widely popular due to the characteristic of providing a high-rate of material deposition. The more popular version of this welding process uses two electrically isolated electrodes, which are melted together on a single molten pool. The use of pulsed current has been the tonic of the modern systems for Double Wire GMAW, where out-of-phase current pulses have been commercially claimed to be indispensable for minimizing magnetic interaction between arcs and reaching stable operations. This work is presented as a study carried out about the use of the out-of-phase current pulses technology.

### 2. EXPERIMENTAL PROCEDURE

The electrodes used were 1.2-mm-diameter AWS ER70S-6 class and the contact-tip distance was 22 mm. A gas mixture of 9Ar-8%CO<sub>2</sub> was used at 40 l/min. A torch (isolated potential) was placed perpendicularly at a travel speed of 11.67 mm/s. The pulsing parameters were chosen to provide one droplet per pulse by using a luminescence sensing system. Three combinations of wire feed speed (8/8 m/min, 14/8 m/min and 14/14 m/min) was evaluated at three different power source configurations: with in-phase pulses; with out-of-phase pulses; and no pulse. High-speed synchronized shadowgraphy technique was employed to visualize the arcs and metal transfer.

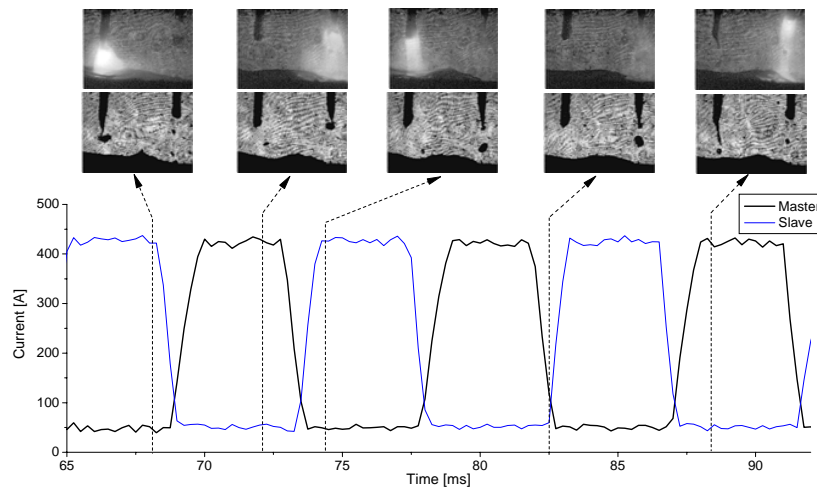
### 3. RESULTS AND DISCUSSION

The obtained synchronized signals (examples can be seen in Figures 1, 2 and 3) show the one drop per pulse condition was confirmed. For the no pulse condition, the transfer resembles spray mode. For the lowest current level there is a strong attraction of the arcs in both no pulse and in-phase configurations, but in the out-of-phase configuration there is no arc attraction. The same behavior is observed for the droplets. In turn, for the intermediate mean current runs, attraction of both arc and droplets gets stronger either in no pulse or in in-phase configurations and some attraction can be seen in the out-of-phase configuration. Finally, for the highest mean current, well above the transition current, the attraction of both arc and droplets gets even stronger in all cases. No difference can be noticed amongst the three configurations. The condition of one drop per pulse cannot be sustained anymore at this current level (even the base current is higher than the transition current for this wire). In all cases, the transfer is spray like. These results suggest that at high current (in which the double wire process present better performance based on production), pulsation does not make any change in the arc performance.

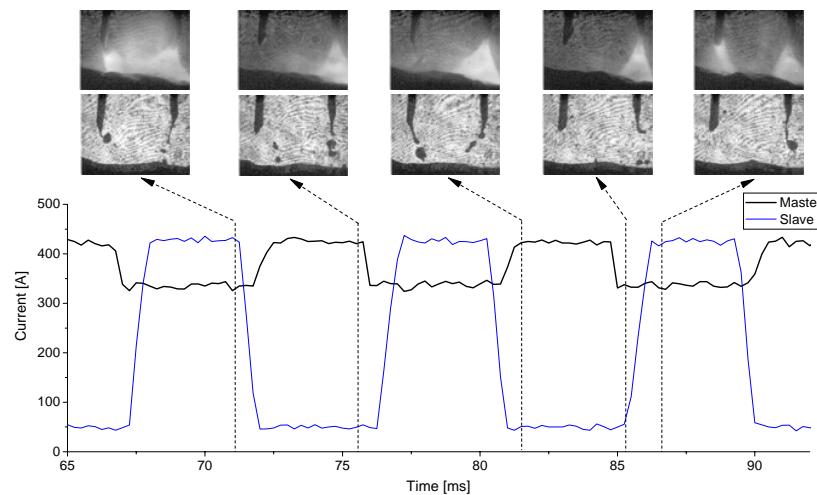
#### 4. CONCLUSIONS

The results showed that the out-of phase pulses really reduces the deviations of the arcs at current levels below the transition current, but this characteristic does not reproduce itself if it exceeds mean currents above that of transition. It means that there is no evidence that out-of-phase current pulses can impose any reduction of arcs and droplets attractions at high level of current, in which the advantages of the Double Wire GMAW process stands out. In summary, it seems that there is no need for having sophisticated equipments with interlaced power sources to succeed with Double Wire GMA welding.

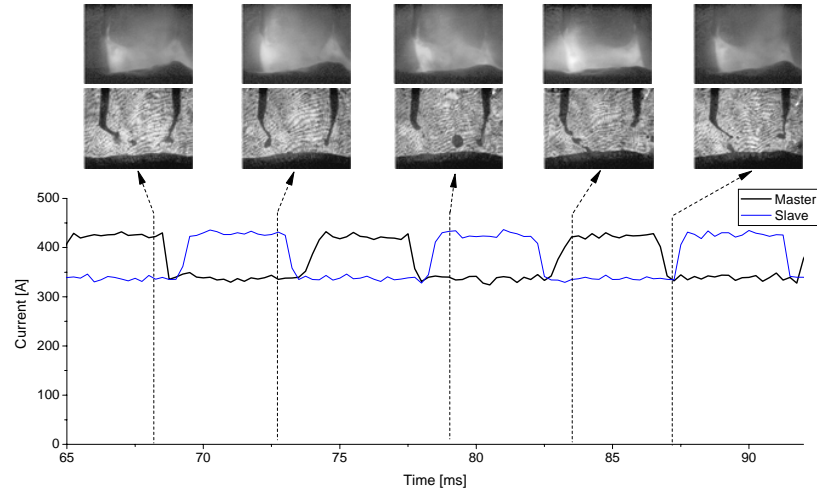
**Keywords:** GMAW; Double Wire; Out-of-phase Pulsed Current.



**Figure 1.** Out-of-phase configuration,  $WFS_{leader} = WFS_{trailing} = 8$  m/min



**Figure 2.** Out-of-phase configuration,  $WFS_{leader} = 14$  and  $WFS_{trailing} = 8$  m/min.



**Figure 3.** Out-of-phase configuration,  $WFS_{\text{leader}} = WFS_{\text{trailing}} = 14$  m/min.

