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Nov 13, 2021

arc-melting V.1

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protocol .

sparks-materials-informatics

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Perform arc melting of various substances.

Sterling G Baird 2021. arc-melting. **protocols.io**
https://protocols.io/view/arc-melting-bz2yp8fw

arc melting, materials science, materials discovery, materials synthesis

protocol ,

Nov 12, 2021

Nov 13, 2021

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The goal is to obtain a homogenous compound consisting of several constituent materials. The minimum total runtime required to obtain this homogeneous compound should be used which may require removing and observing the sample before placing it back into the arc melter for additional time.

Do not look directly at the arc from the arc melter. The electromagnetic radiation can damage your eyes, similar to looking directly at the sun. It is OK to look at the arc through the window of the shield.

Do not touch the hearth while it is hot. Allow time for the components to cool before removing.

:

Measure and record the mass of each of the starting materials prior to arc melting.

Setup 40s

1 Sum the masses of the individual components (m_i).

Total mass of components	

2

Load the material onto the copper hearth inside the half-spherical depression and place a piece of titanium nearby to prevent oxidation.

The titanium piece is used to absorb oxygen and prevent oxidation of the components.

3

Make sure the argon is flowing. Leave the regulator set to the default flow rate.

The argon gas tank should be set to **20 psi** (right dial).

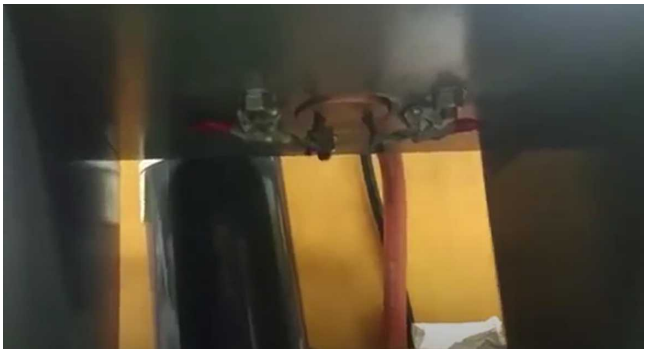
There are multiple electrodes, but we only use the one pointed out in this image.

Ensure that the tungsten electrode makes contact with the copper hearth, but that it is not touching the sample.

Ensure that the water is flowing (open the middle spicket all the way).

Verify that the arc melter housing is cool to the touch.

4



Load the copper hearth beneath the arc melter and secure using the clamps.

5

Place the shield around the arc melter.

Do not look directly at the arc. The arc should only be observed through the window of the shield to prevent eye damage (similar to looking directly at the sun).

6

Turn on the power supply.

Arc Melting

7

10s

Idealarc® R3R-500 Stick Welder
Arc Melter

Lincoln Electric **K1286-16**

Specifications
Dimensions (H x W x D) 27.5 in x 22.3 in x 32 in (699 mm x 566 mm x 841 mm)
Net Weight 402 lbs (183 kg)
Gouging (CAC-A)
Max Rating 625
Amphenol Pins (type of connector) 6
Work Lead Connector Type Lug
Stick Welders Amperage 500A/40V/60%
Stick Welders Duty Cycle 60%
Basic Specification
Input Voltage 460,220/230/240
Input Current 88/44A
Input Hertz 60
Input Power 230/460/3/60
Input Phase 3
Output Range 75-625A DC
Rated Output 500A/40V/60%

Flip the power switch on for **00:00:05** and then flip the power switch off.

If the materials haven't fully melted, run the arc melter for an additional **00:00:05** while moving the electrode across the top of the hearth using the shaft connected to the electrode. Only use the shaft above the arc melter to move the electrode.

Ideally, the melted substance will be spherical, as shown by the glowing dot in the image.

The melted substance is spherical.

Disassemble 40s

8 Wait **00:00:30** for the hearth to cool. 35s

Ensure that the bottom of the hearth is cool to the touch before removing.

Remove the hearth from the arc melter.

If the compound consists of multiple individual pieces, use tweezers to place these back into the semi-spherical depression and remelt for **00:00:05** (**go to step #7**).

Calculations

9 Measure the weight of the final product, excluding the titanium (mf).

Mass of final product	

10 Subtract the final mass from the initial mass to determine the lost mass (m_{loss}).

$$m_{loss} = m_i - mf$$