Polyarc Reactor Replacements
By Connor Beach, Sales Engineer

April 20, 2022

As a Polyarc user it is important to recognize when to replace a Polyarc and the causes of replacements. This prevents using a reactor for too long, possibly leading to incorrect quantification or unexpected downtime. Instructions for replacing a Polyarc reactor are at the bottom of this article.

There are three common ways to cause a Polyarc to function improperly. The three modes of failure are exposure to silicon, disconnecting the Polyarc while still hot, and exposure to sulfur. The first two will be noticed by tailing of your active analytes. See Figure 1 for an example of this.

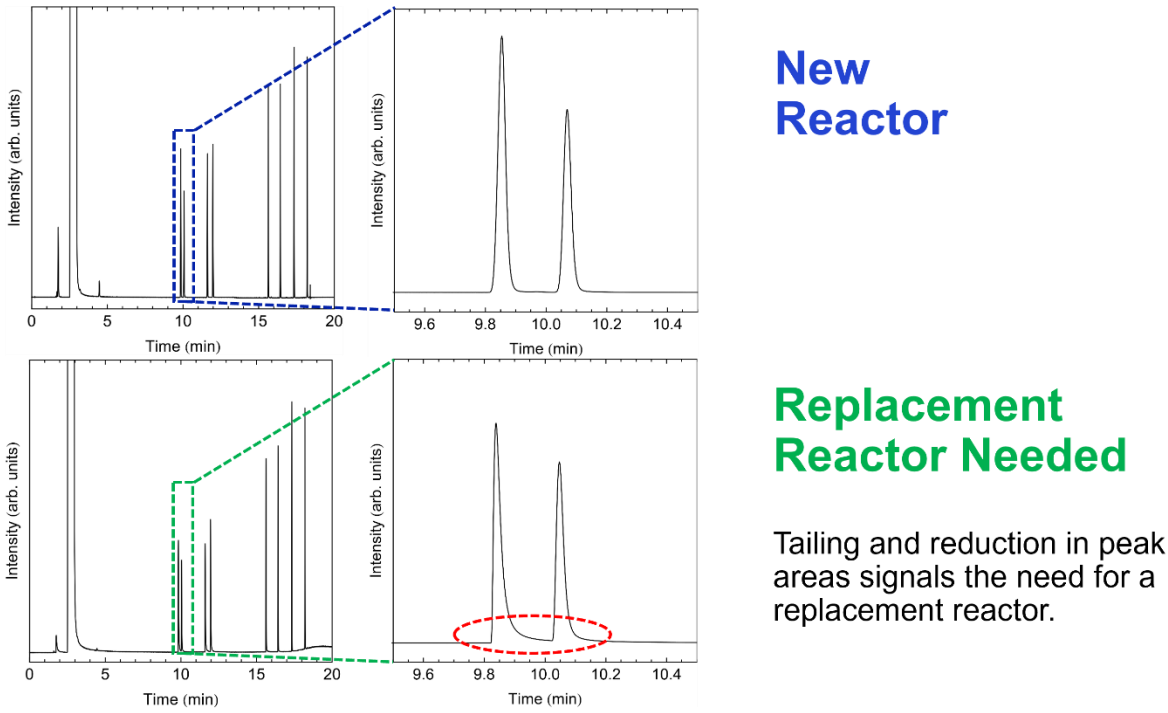

Figure 1 | Polyarc Reactor Replacement. Exposure of the Polyarc to silicon or ambient conditions while hot can cause significant peak tailing.

Silicon exposure can occur from derivatized compounds, silicon oil, or column bleed from high oven temperatures with a PDMS column. It may be unavoidable to prevent silicon exposure depending on the analysis requirements. Using a column with low bleed, a non-PDMS stationary phase, or alternative derivatization methods can help mitigate this issue. Exposure to ambient air happens in two ways: improper maintenance or loss of power. Exposing the Polyarc inlet flow path to ambient air while hot (450°C) will cause active sites in the reactor flow path. The Polyarc reactor should always be cooled down before disconnecting from the column flow path. Alternatively, it is not rare for a laboratory to lose power. The Polyarc will remain hot for an

extended period, while the carrier gas pressure will be lost at a faster rate. This can result in active sites form inside the reactor flow path that causes tailing. It is a good laboratory practice to have an uninterruptible power supply (UPS) if this will frequently happen for any GC system.

The other failure mode is sulfur exposure. Exposure to sulfur greater than 0.60 mg of S will result in a total loss of response from the FID. Sulfur containing compounds should be minimized to less than 1,000 ppm S for a standard 0.1 uL liquid injection (~500 uL headspace injection). An example of deactivation from sulfur exposure is shown below in Fig. 2.

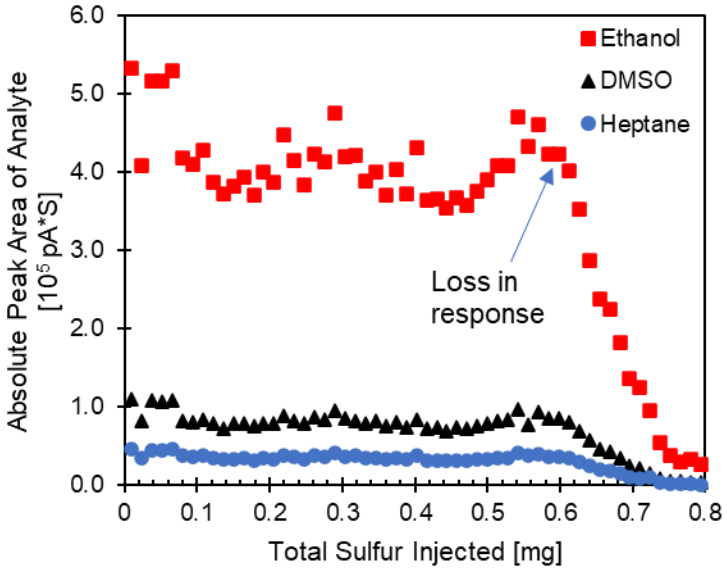

Figure 2 | Deactivation of the Polyarc from Sulfur Exposure. The Polyarc reactor can handle a cumulative amount of 0.6 mg of sulfur before showing signs of deactivation for higher concentration analytes first. Injections were for samples with 14 wt% S and 0.1 µL splitless injection.

Sulfur causes irreversible damage to the second stage in the Polyarc reactor, which leads to incomplete reduction of CO_2 to methane. To avoid unnecessary downtime from sulfur exposure, a spare Polyarc reactor can be kept at your facility for immediate replacement.
Please reach out with the Polyarc serial number for a quote on a replacement as needed.

Replacement Procedure:

1. Cool the existing Polyarc and FID to room temperature.
2. Once cool, disconnect the two Swagelok supply lines for air and hydrogen from the Polyarc, leaving the union connected to the lines for use with the next Polyarc.
3. Disconnect the Polyarc inlet transfer line from the Agilent Ultimate union. Keep the analytical column connected to this union.
4. Disconnect the Polyarc from the FID. The FID column nut and graphite ferrule can be re-used.
5. Disconnect the Polyarc heater cable from the GC or ARC Temperature Controller.
6. Carefully remove the Polyarc from its position on the GC.

7. Unpack the replacement reactor from its box and carefully place it onto the GC, taking care to avoid crimping or bending the transfer lines as they're guided into the GC.
8. Connect the air and hydrogen supply lines using the Swagelok unions. Ensure the proper gases are connected to the proper lines.
9. Connect the Polyarc inlet transfer line to the Agilent Ultimate union. This line will already have a nut and ferrule swaged on.
10. Connect the Polyarc outlet to the FID, re-using the existing 0.8mm graphite ferrule if possible, and trimming the metal capillary after sliding the graphite ferrule onto it.
11. Connect the Polyarc heater cable to the GC or ARC Temperature Controller.
12. Heat the Polyarc. The Polyarc may need to be conditioned for an hour to remove any residual buildup from shipping.