CLAIMS

1. A method for generating an aqueous gas solution comprising dissolved gas in an aqueous stream, the method comprising:

mixing an aqueous acid precursor solution and an aqueous salt precursor solution at an in-line mixing location to produce a liquid precursor mixture, wherein both the aqueous acid precursor solution and the aqueous salt precursor solution are fed under pressure through individual inlet pumps upstream of the in-line mixing location;

introducing the liquid precursor mixture under pressure through an inlet tube of a self-pressurized flow cell downstream of the in-line mixing location, wherein the inlet tube is surrounded by a sealing mechanism to maintain pressure within the self-pressurized flow cell; and

allowing the reaction of the aqueous acid precursor and the aqueous salt precursor to generate the aqueous gas solution and produce a pressure level that correlates to an amount of dissolved gas produced once in the self-pressurized flow cell,

wherein the aqueous gas solution undergoes real-time testing within the self-pressurized flow cell; and

wherein the real-time testing comprises corrosion testing.

2. The method for generating an aqueous gas solution of claim 1, wherein the real-time testing further comprises electrochemical measurements, pH measurements, ultraviolet-visible (UV-VIS) spectroscopy, weight loss, or combinations thereof.

3. The method for generating an aqueous gas solution of any of the preceding claims, wherein the aqueous gas solution is reacted with a sample, thereby producing a reacted aqueous gas stream.

4. The method for generating an aqueous gas solution of claim 3, wherein the sample comprises conductive material.

5. The method for generating an aqueous gas solution of claim 4, wherein the conductive material comprises steel, copper, aluminum, platinum, gold, silver, iron, brass, bronze, alloys, or combinations thereof.

6. The method for generating an aqueous gas solution of claim 3, wherein the reacted aqueous gas stream undergoes testing comprising optical spectrometry or inductively coupled plasma (ICP) atomic emission spectroscopy or Fourier transform infrared spectroscopy, attenuated total reflection infrared spectroscopy, once the aqueous gas stream reacts with the sample and is transferred from the self-pressurized flow cell through an outlet tube.

7. The method for generating an aqueous gas solution of claim 6, wherein the reacted aqueous gas stream is transferred from the self-pressurized flow cell through an outlet tube.

8. The method for generating an aqueous gas solution of claim 7, wherein the reacted gas stream is further bubbled through a basic solution.

9. The method for generating an aqueous gas solution of claim 6, wherein the outlet tube further comprises a pressure regulating device that prevents depressurization of the self-pressurized flow cell.

10. The method for generating an aqueous gas solution of claim 9, wherein the pressure regulating device comprises an outlet pump, a back pressure regulator, or combinations thereof.

11. The method for generating an aqueous gas solution of any of the preceding claims, wherein the aqueous acid precursor solution comprises sulfuric acid, hydrogen iodide, hydrogen bromide, perchloric acid, hydrogen chloride, chloric acid, nitric acid, or combinations thereof.

12. The method for generating an aqueous gas solution of any of the preceding claims, wherein the aqueous acid precursor solution has a concentration of between 5 μM and 10 M.

13. The method for generating an aqueous gas solution of any of the preceding claims, wherein the aqueous salt precursor solution comprises sodium sulfide, sodium sulfate, sodium carbonate, magnesium chloride, calcium chloride, potassium chloride, and combinations thereof.

14. The method for generating an aqueous gas solution of any of the preceding claims, wherein the aqueous salt precursor solution has a concentration of between 5 μM and 10 M.