CLAIMS

1. A multi-phase testing system for testing corrosive environments by providing a test fluid mixture that is at a different phase at different vertically stratified locations within the system in surrounding relation to a plurality of test coupons, in which corrosion rates can be determined via weight-loss means and electrochemical means on the plurality of test coupons each having an outer face exposed to the test fluid mixture environment, comprising:

a housing defining an inner chamber;

a plurality of inserts disposed vertically within the housing, each insert defining an interior area, an inner surface, a plurality of grooves in the inner surface each arranged for receiving a correspondingly shaped coupon via insertion and removal in the direction of the vertically stratified test fluid while preventing lateral movement within the groove, and a plurality of baffle-receiving grooves in the inner surface, in which the plurality of test coupons is disposed within the groove with the outer face of each test coupon being flush with the inner surface and in which each test coupon is spaced by the grooves from adjacent coupons by 90 degrees along the inner surface of the insert;

a plurality of electrical probes, in which at least one electrical probe is disposed at an inner surface of each of the plurality of inserts, and each electrical probe having an electrical lead wire electrically connected to the electrical probe and extending outside the housing for reading electrical signals through the wire;

a plurality of baffles, each baffle being received in a corresponding baffle-receiving groove in the inner surface of a respective one of the plurality of inserts; and

a plurality of separator plates, in which one of the plurality of separator plates is disposed between each adjacent insert and in which each separator plate supports one of the plurality of baffles;

in which the separator plates are configured to maintain a separation between each of the phases of the multi-phase test fluid disposed within the housing so that each of the test coupons and electrical probes in each of the inserts is exposed to a different phase of the test fluid;

in which corrosion is measured by measuring the amount of weight-loss of each of the test coupons and by measuring the electrical signals from each electrical probe.

2. A test system according to Claim 1, in which the grooves are each sized and shaped to receive a respective test coupon and electrical probe.

3. A test system according to Claim 1, in which the grooves retain the coupons within the inserts in position for testing.

4. A test system according to Claim 1, in which each insert includes at least one window that permits viewing of the interior area of the insert.

5. A test system according to Claim 1, further comprising a reference electrode and a counter electrode disposed within the housing that provide a reference electrical signal and a counter electrode electrical signal, in which the reference electrical signal and the counter electrode electrical signal are capable of being used, in combination with the electrical signal from the electrical probes, to measure corrosion using electrical signals.

6. A test system according to Claim 1, further comprising a stirring rod for stirring the test fluid disposed within the housing.

7. A test system according to Claim 1, in which each of the plurality of separator plates includes slots sized and shaped to receive and support respective ones of the plurality of baffles and at least a portion of the plurality baffles are received and supported by the separator plates.

8. A method for performing multi-phase testing of corrosive environments via a weight-loss method and an electrochemical method by providing a test fluid mixture that is at a different phase at different vertically stratified locations within the system, comprising the steps of:

providing a test system, the test system including:

a housing defining an inner chamber;

a plurality of test coupons;

a plurality of inserts disposed vertically within the housing, each insert defining an interior area, an inner surface, a plurality of grooves in the inner surface each arranged for receiving a correspondingly shaped test coupon via insertion and removal in the direction of the vertically stratified test fluid while preventing

lateral movement within the groove, and a plurality of baffle-receiving grooves in the inner surface;

in which each of the plurality of test coupons has an outer face exposed to the test fluid mixture, in which at least one test coupon is disposed within the groove with the outer face being flush with the inner surface, and in which each test coupon spaced from adjacent coupons by 90 degrees along the inner surface of the insert;

a plurality of electrical probes, in which at least one electrical probe is disposed at an inner surface of each of the plurality of inserts, and each electrical probe having an electrical lead wire electrically connect to the electrical probe and extending outside the housing for reading electrical signals through the wire;

a plurality of baffles, each baffle being received in a corresponding baffle-receiving groove in the inner surface of a respective one of the plurality of inserts; and

a plurality of separator plates, in which one of the plurality of separator plates is disposed between each adjacent insert and in which each separator plate supports one of the plurality of baffles;

in which the separator plates are configured to maintain a separation between each of the phases of the multi-phase test fluid disposed within the housing so that each of the test coupons and electrical probes in each of the inserts is exposed to a different phase of the test fluid;

providing the test fluid in the inner chamber of the housing;

maintaining the temperature and pressure within the housing such that the test fluid exists as a vertically stratified, multiphase fluid;

determining an electrochemical corrosion rate by measuring the electrical signals from the electrical probes; and

determining a weight-loss corrosion rate by comparing a pre-test and a post-test weight of the coupons,

in which the determined corrosion rates from the test coupons and electrical probes from each respective, vertically arranged insert corresponds to the

corrosion rate for a corresponding, respective phase of the vertically stratified, multiphase fluid.

9. A method according to Claim 8, in which the test system further comprises a stirring rod for stirring the test fluid disposed within the housing.

10. A method according to Claim 8, in which each of the plurality of separator plates includes slots sized and shaped to receive and support respective ones of the plurality of baffles and at least a portion of the plurality baffles are received and supported by the separator plates.

11. A method according to Claim 8, in which the plurality of baffles extend toward a centre of the interior of the insert and into the test fluid mixture environment to prevent vortex formation.

12. A method according to Claim 8, in which the plurality of baffles and the plurality of separator plates are both made from a corrosion-resistant material.

13. A test system according to Claim 1, in which the plurality of baffles extend toward a centre of the interior of the insert and into the test fluid mixture environment to prevent vortex formation.

14. A test system according to Claim 1, in which the plurality of baffles and the plurality of separator plates are both made from a corrosion-resistant material.

15. A test system according to Claim 1, in which the plurality of grooves in the inserts have a dovetail shape and at least a portion of the plurality of coupons have a shape corresponding to the dovetail shape groove.

16. A test system according to Claim 1, in which the coupons extend along a length of the insert such that each coupon is exposed to the vertically stratified test fluid disposed between respective separator plates.