Claims

[Claim 1]

A toughness reliability evaluation method of a tank, the method comprising:

a step of acquiring a requirement fracture toughness value based on a change over time of a predetermined stress intensity factor and a design life of the tank;

a step of acquiring a transition temperature of a material of the tank from a Charpy transition curve based on a Charpy impact test on the material at each of test temperatures;

a step of acquiring a fracture toughness value at each of the test temperatures based on a fracture toughness test on the material of the tank at each of the test temperatures;

a step of acquiring a design tolerance condition that satisfies a fracture toughness characteristic at each temperature index which is a reciprocal number of a difference between each of the test temperatures and the transition temperature, based on a relationship between the temperature index and the fracture toughness value at each of the test temperatures;

a step of acquiring a requirement temperature index based on the design tolerance condition and the requirement fracture toughness value;

a step of acquiring a tolerance Charpy transition curve having a requirement transition temperature based on the requirement temperature index; and

a step of evaluating a toughness reliability of the material of the tank based on the tolerance Charpy transition curve.

[Claim 2]

The toughness reliability evaluation method of the tank according to claim 1,

wherein in the step of acquiring the requirement fracture toughness value, the stress intensity factor when the design life of the tank is reached is acquired as the requirement fracture toughness value, based on the change over time of the stress intensity factor.

[Claim 3]

The toughness reliability evaluation method of the tank according to claim 1 or 2,

wherein in the step of acquiring the transition temperature of the material,

the Charpy transition curve is acquired based on a correlation between each of the test temperatures and an absorption energy when the Charpy impact test is performed at each of the test temperatures, and

based on the Charpy transition curve, a temperature at an intermediate value of an upper limit value and a lower limit value of the absorption energy for the material of the tank is acquired as the transition temperature of the material.

[Claim 4]

The toughness reliability evaluation method of the tank according to any one of claims 1 to 3,

wherein in the step of acquiring the design tolerance condition,

a design line diagram set at a predetermined interval with respect to a correlation line diagram acquired based on the relationship between the temperature index, which is the reciprocal number of the difference between each of the test temperatures and the

transition temperature, and the fracture toughness value at each of the test temperatures is acquired as the design tolerance condition.

[Claim 5]

The toughness reliability evaluation method of the tank according to claim 4,

wherein in the step of acquiring the requirement temperature index,

based on the design line diagram as the design tolerance condition, the temperature index corresponding to the requirement fracture toughness value is acquired as the requirement temperature index.

[Claim 6]

The toughness reliability evaluation method of the tank according to any one of claims 1 to 5,

wherein in the step of acquiring the tolerance Charpy transition curve,

a transition temperature obtained based on the requirement temperature index is acquired as the requirement transition temperature, and

the tolerance Charpy transition curve is acquired based on the requirement transition temperature.

[Claim 7]

The toughness reliability evaluation method of the tank according to any one of claims 1 to 6,

wherein, in the step of evaluating the toughness reliability of the material,

a test piece is collected from the tank which is actually manufactured, and the Charpy impact test is performed on the test piece, and

values of a set test temperature and an absorption energy for the test piece, which are obtained by the Charpy impact test, are determined by using the tolerance Charpy transition curve as a reference.

[Claim 8]

The toughness reliability evaluation method of the tank according to claim 7,

wherein in the step of evaluating the toughness reliability of the material,

the Charpy impact test is performed on the test piece at a preset set test temperature.

[Claim 9]

A toughness reliability evaluation method of a tank for evaluating a toughness reliability of the tank based on a transition temperature of a material of the tank acquired from a Charpy transition curve based on a Charpy impact test on the material at each of test temperatures and a fracture toughness value at each of the test temperatures acquired based on a fracture toughness test on the material of the tank at each of the test temperatures, the method comprising:

a step of acquiring a requirement fracture toughness value based on a change over time of a predetermined stress intensity factor and a design life of the tank;

a step of acquiring a design tolerance condition that satisfies a fracture toughness characteristic at each temperature index which is a reciprocal number of a difference between each of the test temperatures and the transition temperature, based on a relationship between the temperature index and the fracture toughness value at each of the test temperatures;

a step of acquiring a requirement temperature index based on the design tolerance condition and the requirement fracture toughness value;

a step of acquiring a tolerance Charpy transition curve having a requirement transition temperature based on the requirement temperature index; and

a step of evaluating the toughness reliability of the material of the tank based on the tolerance Charpy transition curve.