PENGARUH TEMPERATUR DAN *AGING TIME* TERHADAP LAJU KOROSI TEMPERATUR TINGGI SS304

Zidan Galik

ABSTRAK

Penelitian ini membahas pengaruh temperatur dan *aging time* terhadap laju korosi temperatur tinggi baja tahan karat SS304. Material SS304 dipilih karena penggunaannya yang luas pada aplikasi industri seperti pipa, boiler, dan heat exchanger yang sering beroperasi pada kondisi temperatur tinggi. Penelitian dilakukan dengan memanaskan spesimen pada temperatur 800°C, 900°C, dan 1000°C dengan variasi *aging time* 0,5; 1; 1,5; 2; dan 2,5 jam. Karakterisasi laju korosi dilakukan melalui metode *weight gain*, sedangkan analisis mikrostruktur menggunakan *Scanning Electron Microscope* (SEM) dan *Energy Dispersive Spectroscopy* (EDS). Hasil penelitian menunjukkan bahwa pada temperatur 800°C dan 900°C, lapisan pelindung Cr_2O_3 terbentuk secara stabil dan efektif dalam menahan difusi oksigen, sehingga laju oksidasi relatif lambat. Namun, pada 1000°C, lapisan Cr_2O_3 kehilangan kestabilannya, menyebabkan difusi Fe lebih dominan hingga terbentuk oksida Fe_2O_3 dan Fe_3O_4 yang rapuh, disertai retakan dan pengelupasan. Kondisi ini meningkatkan laju korosi secara signifikan. Secara umum, laju korosi meningkat seiring bertambahnya temperatur dan *aging time*, mengikuti hukum parabolik oksidasi logam. Penelitian ini menegaskan bahwa kestabilan lapisan pelindung oksida sangat dipengaruhi oleh temperatur operasi. Temuan ini diharapkan dapat menjadi acuan dalam pemilihan material dan perancangan komponen mesin yang beroperasi pada kondisi temperatur tinggi agar lebih tahan terhadap kerusakan akibat korosi oksidatif.

Kata kunci: SS304, laju korosi temperatur tinggi, *aging time*, oksidasi, Cr_2O_3

THE EFFECT OF TEMPERATURE AND AGING TIME ON THE HIGH TEMPERATURE CORROSION RATE OF SS304

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ABSTRACT

This research investigates the effect of temperature and aging time on the high-temperature corrosion rate of SS304 stainless steel. SS304 was selected due to its widespread use in industrial applications such as pipes, boilers, and heat exchangers, which often operate under elevated temperature conditions. The specimens were heated at 800°C, 900°C, and 1000°C with aging times of 0.5, 1, 1.5, 2, and 2.5 hours. The corrosion rate was characterized using the weight gain method, while microstructural analysis was conducted using Scanning Electron Microscope (SEM) and Energy Dispersive Spectroscopy (EDS).The results show that at 800°C and 900°C, a stable protective Cr_2O_3 layer was formed, effectively hindering oxygen diffusion and resulting in a relatively slow oxidation rate. However, at 1000°C, the Cr_2O_3 layer lost its stability, leading to dominant Fe diffusion and the formation of brittle Fe_2O_3 and Fe_3O_4 oxides accompanied by cracks and spallation. This condition significantly increased the corrosion rate. In general, the corrosion rate increased with higher temperatures and longer aging times, following the parabolic law of metal oxidation.This study confirms that the stability of protective oxide layers is strongly influenced by operating temperature. The findings are expected to serve as a reference for material selection and the design of machine components operating under high-temperature conditions to enhance resistance against oxidative corrosion.

***Keywords**: SS304, High Temperature Corrosion rate, aging time, oxidation, Cr_2O_3*