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Identification of chemical form of stable carbon released from type 304 and 316 stainless-steel powders in alkaline solution and in acidic solution under low-oxygen condition

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The chemical form of carbon-14 released from irradiated stainless steel is a key parameter in the safety assessment of the sub-surface disposal system in Japan. In this study, unirradiated 304 and 316 stainless-steel powders were immersed in HCl solution and in NaOH solution under a low-oxygen condition to identify the chemical form of the released carbon. The main chemical forms of the carbon were formic and acetic acids in the HCl solution and colloidal carbon in the NaOH solution. Point analysis of the colloidal particles by transmission electron microscopy equipped with energy dispersive spectroscopy showed that C was accompanied with Fe and Cr. Fe and Cr tended to precipitate thermodynamically as hydroxides in an alkaline environment, suggesting that carbon sorbed onto the hydroxide. Meanwhile, in the HCl solution, the hydroxides did not precipitate thermodynamically, so carbon appeared to be released as an ionic form without the formation of metallic hydroxides.

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