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Development of Highly Reactive Alloys for Groundwater and Soil Remediation

As a result of a collaborative research program between EnviroMetal Technologies Inc. and Rio Tinto Metal Powders Inc, a series of highly reactive alloy materials, H_2Omet XR, has been developed for use in groundwater and soil remediation. As many readers are aware, bimetallic materials have been identified for years as potentially reactive enhancements to ZVI, however their major drawback was the progressive loss of this enhanced reactivity, due to poisoning and/or loss of the second metal (often nickel or palladium). As outlined below, Rio Tinto alloys may represent a significant advancement in overcoming this progressive loss in reactivity.

A number of Rio Tinto alloy materials (<150 um grain size) were tested initially in batch tests, and subsequently in long-term column laboratory studies at the University of Waterloo (Fearing, 2010) to confirm that their enhanced reactivity could be maintained in the longer term. Initial batch testing showed that H_2Omet XR material had a higher reactivity than that of the standard H2Omet and conventional cast iron materials (Figure 1).

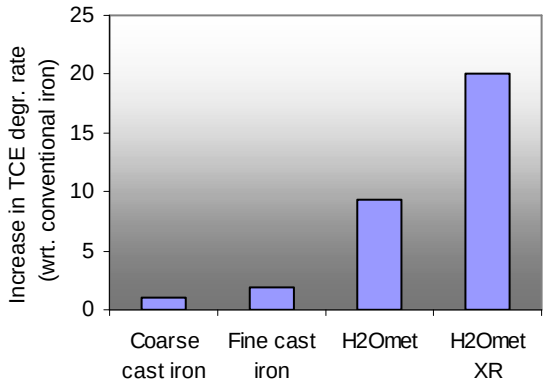

Figure 1: Relative rates of TCE degradation-batch test.

Several thousand-pore volumes of flow were pumped through columns containing various alloys. Representative data from these tests are shown in Figure 2.

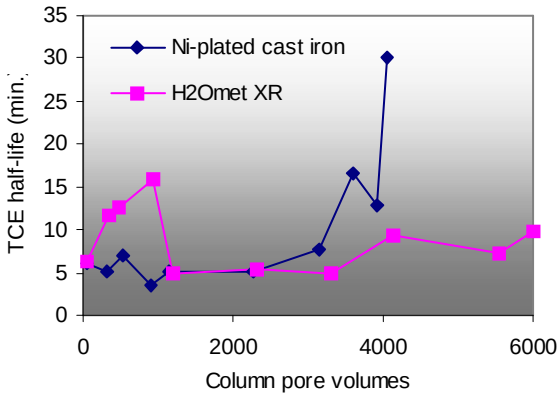

Figure 2: TCE degradation half-lives from a long-term column test.

Half-lives for TCE determined after several thousand pore volumes of flow through a H_2Omet XR column ranged from 5 to 10 minutes (Figure 2). In contrast, the expected significant decrease in reactivity was observed for a Ni-Fe material prepared by Ni cold-plating on base cast iron. Based on concurrent testing, and drawing on historical results from UW; it was deduced that nickel is the key second metal. Specific nickel-iron bimetal alloys were also tested to confirm their performance with respect to the optimal Ni:Fe ratio. These column tests confirmed that the long-term reactivity of these materials was similar to the alloys previously tested.

Field trials of these materials are planned for the summer of 2010. At present, these materials are available at an approximate price of US$1.50/lb for use in pilot-scale applications. These alloys therefore comprise a very cost-effective, longer lasting reactive material where rapid reaction rates are required. Moreover, as they are suitable for injection and have no extraordinary health and safety issues associated with their transport and handling, they may represent an alternative to various nano-scale iron sources currently on the market.

Please call us should you require more information.

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