

Effect of solution pH and chloride concentration on akaganeite precipitation: Implications for akaganeite formation on Mars

T. S. PERETYAZHKO¹, E.B. RAMPE², J.V. CLARK¹, P.D. ARCHER JR¹, R.V. MORRIS², D.V. MING²

¹Jacobs, NASA Johnson Space center, Houston TX, 77058
(tanya.peretyazhko@nasa.gov)

² NASA Johnson Space center, Houston TX, 77058

Akaganeite (β -FeOOH, chloride-containing Fe(III) (hydr)oxide) has been recently discovered on the surface of Mars by the Mars Science Laboratory Curiosity rover in Yellowknife Bay, Gale Crater, Mars [1] and from orbit by the Mars Reconnaissance Orbiter in Robert Sharp crater and Antoniadi basin [2]. However, the mechanism and aqueous environmental conditions of akaganeite formation (e.g., pH and chloride concentration) remain unknown.

We have investigated formation of akaganeite through Fe(III) hydrolysis at variable initial pH and chloride concentrations. The formed Fe(III) precipitates were characterized by instruments similar to instruments on Mars robotic spacecraft. Syntheses were performed through hydrolysis of Fe(III) perchlorate with addition of Na chloride (Fe/Cl ratio between 0.5 and 5) and at initial pH of 1.5, 2, 4, 6 and 8 at 90 °C. X-ray diffraction analysis revealed formation of akaganeite alone or in mixture with goethite, hematite and ferrihydrite at all initial pHs and Fe/Cl ratio between 0.5 and 2 while akaganeite precipitated only at pH 1.5 and Fe/Cl>2. Chloride content of akaganeite was affected by initial pH and decreased from 20-60 mg/g at pH 1.5 to <0.1 mg/g at pH 8. The synthesized akaganeite samples were also characterized by Mössbauer and infrared spectroscopy and volatiles were analysed by thermal and evolved gas analysis. The obtained characterization data will be compared to published data from rover and orbital missions [1-3] to determine martian akaganeite composition, crystallinity and formation conditions.

[1] Vaniman et al. (2014) *Science*, vol. 343; [2] Carter et al (2015) *Icarus* 296-310; [3] Ming et al. (2014) *Science*, vol. 343.