# AbstractID: 6453 Title: Measurement of MRI image degradation in three-dimensional dosimeter made of ion exchange resin beads labeled with ferrous ions

**Purpose: To investigate the rate of MRI image degradation in a three-dimensional dosimeter made of ion exchange resin beads labeled with ferrous ions and to compare the rate to MRI image degradation in a three-dimensional ferrous-gel dosimeter.**

**Method and Materials: A three-dimensional dosimeter material was made by labeling cation exchange resin beads with ferrous ions. After hydration, the beads contain a low pH solution. Adding ferrous ions makes each bead a self-contained Fricke chemical dosimeter. A container packed with these beads forms a tissue equivalent three-dimensional dosimeter. Dosimeter samples exposed to 6 MV x-rays and evaluated using MRI show a linear R1 versus dose response of 0.10 to 0.09 $sec^{-1}$ $Gy^{-1}$ similar to a ferrous-gel dosimeter. Diffusion of ferric ions is problematic for ferrous-gel dosimeters, as diffusion results in rapid blurring of dose distribution information. For comparison, two sample vials were prepared, each consisting of a layer of unlabeled beads interfaced to a layer of either ferrous or ferric ion labeled beads. MRI scans of R2, which is proportional to ferrous and ferric ion concentration, versus distance from the bead layer interface were made of the vials when constructed and six days later. To evaluate chemical diffusion, scan results were fit to the error function complement and changes between initial and final scans were used to calculate the diffusion constants.**

**Results: Diffusion constants for ferrous and ferric ions in the ion exchange resin bead dosimeter were $1.5 \times 10^{-5}$ and $2.5 \times 10^{-6}$ $cm^2/hr$, respectively. These are significantly less than the ferric ion diffusion constant in ferrous-gel dosimeters, which is $1.5 \times 10^{-2}$ $cm^2/hr$.**

**Conclusion: In comparison to the image blurring of a ferrous-gel dosimeter, blurring of dose distribution information due to diffusion does not appear to be a problem with the ion exchange resin bead dosimeter material.**