Geoscience 777 Exercise 6: DTSA-II 3rd 3/5/19 Name _____

Using DTSA-II to simulate (1) particles, and (2) VP-SEM

1. Using the thin window Oxford AZtect SDD detector you created,:

Problems/simulations: Tools→ Simulation alien→MC model of a sphere on bulk, homogeneous substrate.

2. Create a substrate of pure Fe (density 7.87 g/cm^3). Sphere of quartz SiO_2 (density 2.65 g/cm^3), 1 um diameter. (Do not overscan in today's exercise). Set beam to 15 keV, 20 nA, 0.0 incident angle. Apply simulated count stats, 1 count, run default # trajectories, use characteristic, bremsstrahlung, and fluorescence (characteristic secondary and bremsstrahlung secondary). No variable pressure (yet). Run the simulation.
In "Spectrum" what peaks (element, line) do you see?

Now click on "Report" where very interesting information and images can be seen (and you will have to scroll down for subsequent simulations as they are pasted one after the other): the tables give intensities Generated (within sample) and Emitted (after absorption by material) [Here they use the correct, traditional terminology unlike CASINO!] You can compare, for the same x-ray, the (x-ray) fluorescence amount to the (electron generated) characteristic amount. Keep scrolling down…. for color images (cross section) of the x-rays generated in the sphere and the substrate. Note the lateral and depth dimensions are given. Describe what you see here.

Why are Fe x-rays being generated?

3. Now reverse the simulation: use an SiO_2 substrate, with a 1 um Fe sphere. What is the result?

Why?

4. Let's see what happens when we have a 10 um SiO_2 sphere upon Fe substrate. What happened?

Why?

5. OK, now let's simulate a variable pressure scenario for this last configuration (10 um SiO_2 sphere on Fe substrate): Nitrogen, path length 10 mm, 40 Pa pressure. Can you predict what might be the result???

What do you see? Note now that the image is scaled much larger (dimensions given at top of each image).

Also note that a table is now given with the skirt information. 90% of the electrons are within what radius? ___ um 99% within what radius? ___ um

6. What happens if you increase the gas pressure to 100 Pa and path length to 20 mm?

Write a brief summary discussing some issues involved with particle analysis in both high vacuum and VP-SEM modes. Discuss briefly DTSA-II's usefulness.

Version history: 2/27/12 2/19/13 10/02/16 2/27/18