

NNCI—Nanoscale Science and Engineering

Exploring Surface Effects

Explore!

1. Take an Alka Seltzer® tablet and break it in half.
2. Take one half and grind it with the mortar and pestle.
3. Place the one half piece in one film canister and the ground half in another canister.
4. **Quickly** fill each canister 1/2 full with water and put caps on canisters.
5. Which one blows its top first?



What is happening?

You placed the same amount of materials in each of the canisters but the one with the ground material reacted faster. Can you think of why they would be different?

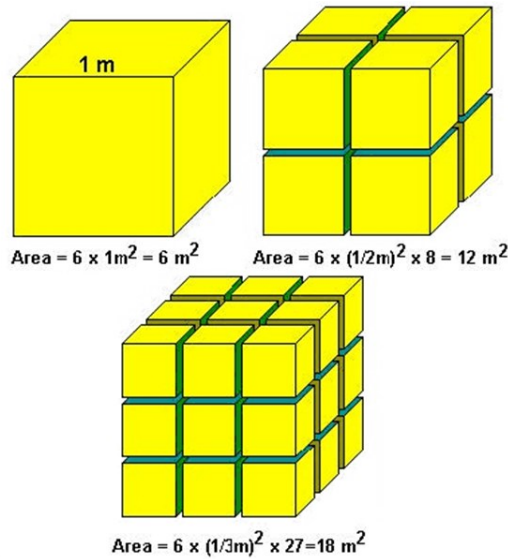
The ground tablet reacts faster causing more CO₂ bubbles to form in a shorter amount of time. This happens because the ground half of the tablet has a greater surface area to volume ratio. The ground tablet has more outside surface to react with the water—more atoms are on the surface of the material compared to the solid half. Therefore, the water can reach more of the Alka Seltzer® resulting in a faster reaction.

What does this have to do with nanotechnology? As a material gets smaller - moves towards the nanoscale - its surface area increases which as you have seen has an effect on reactions. The catalytic converter in your car uses platinum a very expensive metal (~\$1300/oz). Using nanoparticles of platinum means you can use less and have a very effective reaction because of the large surface area of the nanoparticles.

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Exploring surface area to volume ratio. The three cubes have the same volume but the surface area increases as the cube is cut into smaller pieces.



http://nanosense.sri.com/activities/sizematters/properties/SM_Lesson3Teacher.pdf

Reduced particle size increases surface area



Increased surface area leads to faster dissolution

Image at: www.iroko.com