How many C atoms in a SAM?

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Solution: This problem has one tricky aspect. You need assume an area. Let's assume that the area is 1 cm^2.

Then we calculate the volume (in m^3 is probably best)

$$V = A\ell = (10^{-2}\,m)^2(1.4\,x\,10^{-9}\,m)$$
$$= 1.4\,x\,10^{-13}\,m^3$$

Now we do exactly the same set of steps we used for the Au nanoparticle with one difference. We use CH_2.

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The CH_2 as a unit means that we will use its molar mass, the number of CH_2 units will equal the number of C atoms. First, we

calculate the mass

$$m = \rho V$$

and then the number of moles

$$n = \frac{\rho V}{M_m}$$

and then the number of molecules

$$N = \frac{N_A \rho V}{M_m}$$

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and then the number of molecules

$$N = \frac{N_A \rho V}{M_m}$$

We can plug in the values:

$$N = \frac{(6.022\ x\ 10^{23})(1250)(1.4\ x\ 10^{-13})(1000)}{14}$$

which gives N = 7.52×10^{15}. This seems like a large number, but recall that we are calculated the number in a square centimeter. This is reasonable.

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The unit analysis is:

$$N = \frac{\left(\frac{molecules}{mole}\right)\left(\frac{kg}{m^3}\right)(m^3)(1000\ \frac{gm}{kg})}{\frac{gm}{mol}}$$

The units are the only tricky part here. When using M_m
We often need to use the factor of 1000 to convert to kg in order to be compatible with MKS units.