HEAT/SP HEAT/LATENT

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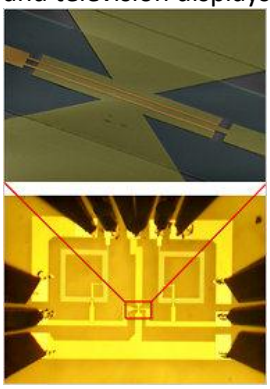
I.B.M. Researchers Create High-Speed Graphene Circuits

I.B.M. researchers said Thursday that they **had designed high-speed circuits from graphene**, an ultra-thin material that has a host of promising applications, from high-bandwidth communication to a new generation of low-cost smartphone and television displays.



INTRODUCTION: The specific heat of silicone carbide is 710 J/K^0 kg. Note a K^0 is the same size as a C^0. The Latent Heat of vaporization of silicone carbide is 342 KJ/kg. QUESTION: (a) Find the heat(in J) needed to bring 100 g of silicon carbide from 21^o C to 1350^0 K and vaporized? (b) Show the working equation you used to find the heat needed? HINT: See the graphic at bottom of page.
C = Q/m(delta T) , L_v = Q/m

ANSWER: (a) ~ 109,210 J or ~ 109.2 KJ (b)_____-

I.B.M.An image of a completed integrated circuit made from graphene, with detail at top.

The I.B.M. advance, which the researchers reported in the journal Science, is a circuit known as a broadband frequency mixer that was built on a wafer of silicon. Widely used in all kinds of communications products, the circuits shift signals from one frequency to another. In the Science paper, the I.B.M. researchers describe a demonstration in which they deposited several layers of graphene on a silicon wafer, then created circuits based on graphene transistors and components known as inductors. They demonstrated frequency mixing up to speeds of 10 gigahertz. In the past ***I.B.M. has created stand-alone graphene transistors, but not complete electronic circuits.*** Scientists began making flakes of ***graphene, an atomic-scale lattice of carbon atoms, in the 1970s. They have gradually refined the process so they can now produce films of the material that are just a single atom thick.*** The film arranges itself in a hexagon-shaped array of carbon atoms and has the advantages of being flexible, transparent and inexpensive to manufacture.

But it is not yet a candidate to replace today's CMOS transistors, the basis for the microprocessors and computer memories in consumer electronics systems. Graphene does not have the same physical properties as semiconducting materials and cannot be used to completely switch on and off in the way that logic transistors are meant to do. Both the European Union and South Korea have recently started $1.5 billion efforts to build industrial-scale efforts using graphene as a next-generation display material, he said. Singapore has also recently started a major investment in the material. He acknowledged that while I.B.M. was now able to build circuits from the material, it was still learning reliable ways to make large quantities of graphene film. ***It is now possible to heat a silicon carbide wafer to about 1,350 degrees Celsius (nearly 2,400 Fahrenheit), causing the silicon atoms on the surface to evaporate and the remaining carbon atoms to rearrange themselves into the hexagonal graphene shape.***