

Abstract of Presentation

'The (Continuing) Challenge of High Temperature Superconductivity'

Abstract :

We know that superconductivity is a dramatic natural phenomenon. Cooling a superconducting chemical element or material to its critical temperature, T_c , induces a catastrophic drop in electrical resistance to **zero**, or so close to zero that an electric current induced in a fashioned ring will continue to flow around it, unaided and with undiminished intensity for many, many years. Such a system below T_c now having a conductivity of **infinity**, also enters a state of **perfect** diamagnetism. This led Albert Einstein to a beautiful comment on superconductors ...

*"Their charm is in three words; **zero, infinity and perfect.**"*

The current record T_c is around 165K for a black, dense and chemically complex ceramic oxide, the mercurocuprate $\text{Hg Ba}_2 \text{Ca}_2 \text{Cu}_3 \text{O}_{8+\delta}$. Surely, nothing in one's experience of a quarter of a century of High T_c superconductivity indicates that the challenge of discovering a room-temperature (or even higher temperature) superconductor with high current-carrying ability cannot be met.

But where can one focus – or indeed even begin to focus – any major new search across the venerable Periodic Table? And how on earth can one begin to 'model' this ultimate 'Advanced Material'?

Sir Nevill Mott once confided in me...

"Peter, I believe the first room temperature superconductor will be from the hands of a person skilled in synthesis – guided by chemical and physical insights and intuition ... and ... hopefully ... theory."

My view is that the very first step in this journey will derive much from this marvellous, insightful summary of the phenomenon of High T_c .

I will attempt to outline some emerging thoughts on a personal perspective of High T_c , in which one must couple something of the characteristic chemistry of the elements of the Periodic Table with key ingredients of the essential physics of the phenomenon (or what I believe to be the essential physics!).