

# This Week's Citation Classic

**Pollack G L.** The solid state of rare gases. *Rev. Mod. Phys.* **36**:748-91, 1964. [National Bureau of Standards, Washington, DC]

This is a comprehensive review article on solid Ne, Ar, Kr, Xe, and Rn. The article describes the intermolecular forces, the structures and other physical properties of the solids, and experimental and theoretical methods of studying them. Properties are displayed in several figures and tables. [The **SC<sup>i</sup>**® indicates that this paper has been cited over 320 times since 1964.]

Gerald L. Pollack  
Department of Physics  
Michigan State University  
East Lansing, MI 48824

June 15, 1981

"Who can accurately tell any motivation, especially one 20 years in the past? I think I wrote this review article to bring together all the work that had been done on rare-gas solids while that was still possible. In the end, I did have to omit mechanical properties, optical properties, etc., from the review in order to keep it within reasonable spatial and temporal bounds.

"I had been doing research at the National Bureau of Standards, with the late Herbert P. Broida, who was a wonderful scientist and friend. We were working on absorption spectroscopy of simple molecules embedded in matrices of solidified inert gases. As we experimented with the rare-gas solids we became increasingly interested in their solid state per se.

"One reason why rare-gas solids, i.e., solid Ne, Ar, Kr, Xe, and Rn, are so interesting is that they are prototype molecular solids. In short, these solids are theoretically tractable in the sense that if there are any solids whose properties can be calculated from quantum-mechanical first principles, these are the ones. However, some of the same properties that make them theoretically tractable cause the rare-gas solids to be difficult to experiment on. The solids only exist at low

temperatures or high pressures, single crystals are difficult to grow, the thermal expansivities are high, etc.

"I tried to put in the article the best values of the physical properties I could find in the literature. I also aimed to display these data in new figures and tables that would be easy to use and remember. In the experimental sections I tried to briefly describe the specialized techniques that were used, and in the theoretical sections I aimed at outlining the main hypotheses and the resulting equations. I think that it is on account of the usefulness of those things that the paper has been often cited.

"As I studied the literature and thought about the results, I got some ideas on what seemed to be the next most interesting research to do on the rare-gas solids. For example, it is important to learn how to grow large single crystals, to get improved data on thermal conductivity and to understand it theoretically, to understand why the solids have the observed crystal structures, etc. I tried to put in the review some suggestions leading along these constructive research paths. At optimistic times I like to think that my article did help stimulate people to work in this field on those problems.

"At the time I completed the review, the National Bureau of Standards had a useful but somewhat ponderous internal review system for papers. The system operated in the 'fullness of time.' In the end, I obtained the best advice on the paper from my friend Floyd A. Mauer. Imagine my pleasant surprise when the editor of the *Reviews of Modern Physics*, E.U. Condon, accepted the paper after only a week from the time I sent it to him. I've always assumed that he so speedily refereed it himself; there were giants on the Earth in those days. Recalling the three people and the five elements mentioned above makes me want to write another review. This field has recently been reviewed in *Rare Gas Solids*.<sup>1</sup>

1. Klein M L & Venables J A, eds. *Rare gas solids*. New York: Academic Press, 1976-1977. Vols. 1 and 2.