

Disorder in superconductors—a study on $\text{Cu}_2\text{Mo}_6\text{S}_8$

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Abstract. Some of the recent work on disorder-induced changes in T_c is reviewed. Shock-pressures induce a disorder uncomplicated by antisite disorder typical of particle irradiation, and have generated interest because of the shock-synthesis of A-15 Nb_3Si . In this paper we present our results on laser-induced shock-damage, and compare it with the results on V_3Si and the results on particle irradiation of Chevrel phase superconductors.

Keywords. Superconductors; disorder.

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1. Introduction

The effect of disorder on superconductivity has been studied for about a decade now. In addition to affecting the normal state properties, disorder affects the three macroscopic superconducting parameters viz, transition temperature, critical field and critical current. The last two are of interest in view of the large scale applications of superconducting magnets, but in this paper we shall concentrate on the effect of disorder on the transition temperature T_c .

Disorder has been introduced in the past by irradiation with fast neutrons (Sweedler *et al* 1978; Brown *et al* 1977), with protons (Dierker *et al* 1983) and with heavy charged particles (Lehmann *et al* 1981; Adrian *et al* 1981). Some representative results in high T_c materials will be reviewed in the next section. Superconductors have also been prepared in the disordered state by going off-stoichiometry or by quenching. We shall also review in § 2 some theoretical efforts to explain the variation of T_c with disorder in terms of variations caused in relevant microscopic parameters like the electronic density of states $N(E_F)$, the electron-phonon coupling λ , and Coulomb repulsion μ^* . In § 3 we present our results on laser-induced shock damage in $\text{Cu}_2\text{Mo}_6\text{S}_8$ and compare them with other recent results on shock-damaged superconductors. We conclude by comparing our results with earlier studies on neutron irradiated and charged-particle irradiated Chevrel phase superconductors, and present a possible explanation for the apparently conflicting results.

2. Disorder in superconductors—status review.

Sweedler *et al* (1978) studied the change in T_c of various A-15 compounds under irradiation with fast neutrons for fluence ($E > 1$ MeV) upto 10^{20} neutrons/cm². On