



Fig. 17. Bright field TEM images of typical defects in CVD diamond: (a) and (b) $\{111\}$ stacking faults, (c) and (d) $\{111\}$ twins, and (e) and (f) dislocations. Arrows in image (b) indicate interactions between stacking faults, and arrows in image (f) indicate aligned end-on dislocations. Reproduced with permission from [229], Noyes Publishing.

2.3.5. Raman Spectroscopy

Raman spectroscopy has been the most widely used tool for the examination of the types of bonding present in carbon films. It is a complementary technique to IR spectroscopy. The Raman signals correspond to inelastically scattered light resulting from the radiative emission of dipoles induced by the electric field of the incident light and coupled with atomic vibrations. The Raman efficiency depends on the polarizability and electron-phonon interaction of the solid. Using Raman spectroscopy, diamond, which has a phonon density of states very different from other carbon phases, can be detected without any ambigu-

ity. The Raman signal is very sensitive to short-range disorder and subsequently, it can reveal different forms of amorphous carbon i.e., a -C or a -C:H, and graphite. The position of various Raman bands, their FWHM values, observed in CVD diamond films, and their corresponding assignments are given in Table X.

Diamond belongs to the face centered cubic lattice with space group $Fd\bar{3}m$. There are two carbon atoms in the primitive cell and it has a single triply degenerate first order phonon with symmetry T_{2g} . From the selection rules for the factor group O_h , this mode is expected to be Raman active only; the diamond structure has no first order infrared absorption. Raman