reaction-diffusion process after the rupture of any reaction couple, it is necessary first to analyse the growth kinetics of the same compound layer in different reaction couples of a multiphase binary system. This will be done in the next chapter.

3.9. Multiple compound layers: short conclusions

1. Though there are no restrictions on the number of compound layers growing simultaneously in the reaction controlled regimes, from a physicochemical viewpoint their formation in the *A*–*B* reaction couple of a multiphase binary system must be sequential and not simultaneous.
2. The sequence of their occurrence is determined by the rates of chemical transformations at the interfaces. It cannot yet be theoretically predicted with full confidence for any particular reaction couple *A*–*B*. Having sufficient information on the equilibrium phase diagram, thermodynamics of chemical reactions, and the structure and physical-chemical properties of the compounds, it is possible to indicate those of them, which are most likely to occur and grow first at the *A*–*B* interface.
3. The layers of no more than two compounds can grow simultaneously in the diffusion controlled regimes. The layer adjacent to substance *A* or the *A*-enriched phase grows at the expense of diffusion across its bulk of only *A* atoms. The layer bordering with substance *B* or the *B*-enriched phase grows at the expense of diffusion across its bulk of only *B* atoms. Both layers thicken at their common interface.
4. Under conditions of diffusion control, all other compound layers of a multiphase binary system, located between the two growing ones, are kinetically unstable. If these other layers were initially missing from the *A*–*B* couple, they will not occur in it until at least one of initial substances (either *A* or *B*) is completely exhausted. If present, they will disappear completely.
5. In general, there may be no full correspondence between the equilibrium phase diagram of a multiphase binary system and the microstructure of the *A*–*B* transition zone occurred after isothermal annealing of the *A*–*B* reaction couple.
6. If observed, formation of multiple compound layers at the *A*–*B* interface is most likely a result of secondary reactions taking place after the occurrence of cracks in and between reacting phases. The latter is due to volume changes accompanying layer growth and the difference in the coefficients of thermal expansion of the couple

constituents. Though often invoked, the Kirkendall effect is in principle unobservable with growing compound layers and therefore has no relation to the crack occurrence both in their bulks and at the interfaces between reacting phases.

7. One inert marker only indicates the diffusing species in that compound layer in which it is embedded or with which it borders. If this layer grows under conditions of diffusion control, then the very presence of other compound layers provides in itself evidence that another component is diffusing across their bulks.

8. In view of the lack of interdiffusion in the course of multiple-layer formation and because of complicated mechanism of this process, calculation of integrated diffusion coefficients seems meaningless.