Preface

The number of observed spectral lines in diamond is steadily increasing. For example, the remarkable review by J. Walker in 1979 described 30 centers with some 100 lines [Wal79]. The compilation by J. E. Field in 1992 had 118 entries [Fie92]. A. M. Zaitsev in his valuable data collections, had 465 entries in his book chapter of 1998 [Zai98] and 838 entries in his book of 2001 [Zai01]. This book has more than 2,000 entries from some 300 centers. The main entries are presented in 23 tables (see Chaps. 2–7), according to the type of sample, the method of observation, etc. (see Sect. 1.4). Specific tables follow in Chaps. 8–13.

Of special interest for the present author is (1) the interpretation of spectra and (2) the assignment of structures to the optical centers.

In the field of **interpretation**, it was found that in 113 cases line groups arise from resolved donor–acceptor pair (DAP) transitions (see Chap. 10). Only two of them have been published before [Dis94a, Dis94b, Ste99a, Ste99b], i.e., 111 DAPs of this book are unpublished [Dis03]. Unresolved DAP transitions were proposed in 1965 to explain the band-A luminescence [Dea65a]. With the present knowledge, a final proof for this hypothesis is provided (see Table 10.2.2).

The **structure assignment** of optical centers is established for some 15 cases (e.g., $\mathrm{A} = \mathrm{N}_2^\circ, \mathrm{B} = \mathrm{V_1N}_4^\circ, \mathrm{C} = \mathrm{N}_1^\circ, \mathrm{NV} = \mathrm{V_1N}_1, \mathrm{N} = \mathrm{V_1N}_3^\circ, \mathrm{GR1} = \mathrm{V}_1^\circ$). However, for the large number of some 200 proposed structures (preceded by *), confirmation is desirable (e.g., $\mathrm{H3} = *\mathrm{V_1N}_2^\circ, \mathrm{TH5} = *\mathrm{V}_2^\circ, \mathrm{5RL} = *(\mathrm{C}_2)_\mathrm{i}\mathrm{N}_1^\circ$).

In contrast to previous reviews, where up to three possible structures are cited, only the most probable structure is presented here. This selection is based on the available information, like (1) isotope shifts, (2) frequencies of local vibrational modes (LVM), or (3) of quasilocal vibrational modes (QLVM), (4) involvement of intrinsic defects (vacancies or self-interstitials) as evidenced by the connection to a special type of DAP transitions (the sideband DAP, see Chap. 10), and (5) relationships of the value of the DAP dielectric factor with the number of electrons involved (see Sect. 10.4) or with the charge state of the defect (see Sect. 10.5).

Certainly, the large amount of data (especially the new structure proposals) require a critical examination. Each reader is urgently invited to inform the author about errors, improvements, and new results.

The author regrets that no figures are included in this book. It was decided to collect the figures and diagrams in a separate book. Fortunately, the experienced diamond researcher Prof. Alexander M. Zaitsev has agreed to write this book (together with the present author):

Handbook of Spectral Lines in Diamond, Volume 2, Figures and Diagrams by A. M. Zaitsev and B. Dischler, Springer-Verlag, to be published.

This second book provides a good opportunity to update the present data on spectral lines in diamond.

In the meantime, the reader will find figures for most of the lines and bands in two previous books [Zai98, Zai01]. The respective figure numbers are indicated in an extra column in the tables.

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This book is dedicated to the many diamond researchers worldwide, who contributed to the impressive amount of data, which is now available. Instrumental for the present book were the exhaustive data collections by Alexander M. Zaitsev, both in a review article [Zai98] and in a book [Zai01]. Of great help were the reviews of John Walker [Wal79] and of Alan T. Collins [Col97].

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