# Chapter 4

# DOSE RESPONSE OF DOSIMETRIC MATERIALS

**Abstract** In this chapter we discuss theoretical and experimental aspects of the dose response of dosimetric materials, and use analytical equations to fit experimental data. We define the superlinearity index g( D ) , and the supralinearity index f( D ) , and discuss various functions commonly used to describe shape of dose response curves in TL, OSL, OA and ESR signals: the saturating exponential, double saturating exponential, single exponential plus linear and the recently derived equation using the Lambert *W* function. We show how to numerically integrate the equations for the irradiation stage in the OTOR model, and compare with the analytical solution based on the Lambert *W* function. Several detailed R codes are given of fitting experimental data ESR, TL, OSL data, including situations with superlinear dose response. We simulate experiments in which the sample temperature is variable during the irradiation process, and which may affect the dose response of the material. We discuss superlinear dose response as the result of competition between two electron traps during the irradiation, and present experimental data analysis using the new analytical Pagonis-Kitis-Chen (PKC) equation which describes superlinearity effects. This chapter will conclude with an overview of the analytical dose response equations based on the Lambert function, and with a discussion of the importance of the Lambert function in the description of luminescence phenomena.