ANALYTICAL SOLUTION

Equation 1

With q0 = “Equivalent initial mass” =

Equation 2

For the calculation of the residual heat, the heat dissipation after a heat pulse is determined by the heat conduction equation. For an instantaneous point source of energy Q, the solution for the temperature rise inside an infinite homogeneous solid is given by (Bauer et al., 2015)

With n=0 for a plane, n=1 for cylindrical and n=2 for spherical volume.

For an instantaneous heat-pulse applied to an infinite line source in a homogeneous and isotropic medium at a uniform initial temperature, the solution to equation (3) is (Carslaw & Jaeger, 1959)

With

and q in J/m

For the application of an instantaneous line source of heat along the z-axis in an isotropic medium, Marshall (1958) proposed the following analytical solution:

with (K) the difference between the temperature at position (x, y) before application of the heat-pulse and a time t (s) after application of the heat pulse, Q (K.m2) defined as the temperature to which the amount of heat liberated per unit length of the line would raise a unit volume of the substance, the thermal diffusivity (m2/s), and the heat pulse velocity (m/s).