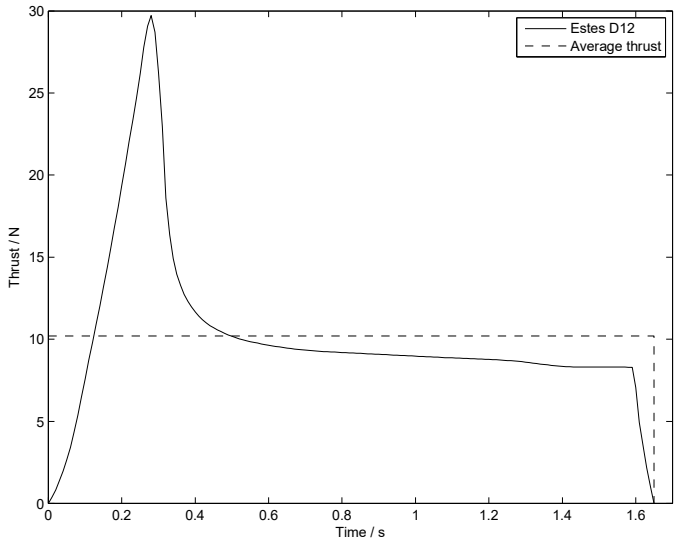

Figure 2.2: A typical thrust curve of an Estes D12-3 rocket motor and its average thrust. [11]

type used in the motor.

Even motors with the same classification code may have slight variations to them. First, the classification only specifies the impulse range of the motor, not the exact impulse. In principle, a D-motor in the lower end of the range might have a total impulse only 1 Ns larger than a C-motor in the upper end of its range. Second, the code only specifies the average thrust of the motor. The thrust rarely is constant, but varies with time. Figure 2.2 shows the typical thrust curve of a small black powder rocket motor. The motors typically have a short thrust peak at ignition that gives the rocket an initial acceleration boost before stabilizing to a thrust level a little below the average thrust. Statically measured thrust curves of most commercial rocket motors are readily available on the Internet [10].

Also the propellant type may affect the characteristics of the motor. Most model rocket motors are made up of a solid, pyrotechnical propellant—typically black powder—that is cast into a suitable shape and ignited on launch. Since the propellant burns on its surface, different thrust curves can be achieved by different mold shapes.

A significantly different motor type, *hybrid motors*, were commercially introduced in 1995. These motors typically include the propellant and oxidizer