Experimental Study on Microstructure near Freezing Front during Soil Freezing.

Kunio WATANABE, Masaru MIZOGUCHI,
Department of Bioresources, Mie University, Japan

Takeshi ISHIZAKI and Masami FUKUDA
Institute of Low Temperature Science, Hokkaido University, Sapporo, Japan

ABSTRACT: The area between the freezing front and the point at which ice lenses form is called frozen fringe
and considered to play an important role in frost heave. We observed the microstructure near the freezing front with a microscope during soil freezing to clarify the frost heave mechanism. When the sample was under a constant temperature gradient, the growth of the warmest ice lens was observed. The growth rate of the ice lens decreased with increasing temperature at the growth surface of warmest ice lens. When samples were moved with a constant velocity at a given temperature gradient to obtain a constant freezing velocity, rhythmic ice lenses were observed. The temperature at which ice started to segregate decreased with increasing freezing velocity. The growth rate of the ice lens increased with increasing freezing velocity. The microscope images showed no evidence of the existence of pore ice in the frozen fringe. These results suggest that the freezing velocity determines the temperature which ice lenses start to form and that the temperature is an important factor for the frost heave mechanism.