Film Formation

One aspect of AFFF foams is their ability to film form. A typical shallow spill fire is when fuel, such as jet fuel, spills across a tarmac and erupts into flame. This is what's known as a shallow spill fire. An AFFF firefighting foam is designed and formulated to form a film across the burning fuel very rapidly thus extinguishing the flames by starving the fire of oxygen.

Film formation occurs when the spreading coefficient is greater than zero. Spreading across a burning fuel is extremely rapid when this Spreading Coefficient is positive.

Spreading Coefficient is determined as follows:

$$S = T_c - T_s - T_i$$

S is Spreading Coefficient
T_c is surface tension of substrate
T_s is surface tension of the foam solution
T_i is the interfacial tension between the foam solution and the substrate

When the Spreading Coefficient is positive film forming will occur.

Typical Fuel Surface Tensions

Table 1: Surface tensions of various fuels.

Fuel or Liquid	Surface Tension (δ_F) [mN/m]	Temperature [°C]
Military relevant fuels:		
F-34 (JP 8)	25.8	23
Jet A1[a]	26.7	24
Diesel[a]	28.3	24
Reference liquid:		
Cyclohexane (p.a.)	24.9	24
Other important liquids:		
Gasoline[a]	20.8	24
Crude Oil[a]	28.5	24
FAME (Bio-Diesel)[a]	31.5	24