

Surface Energy Data for PP: Polypropylene, CAS #s 9003-08-0 (atactic) and 25085-53-4 (isotactic)

Source ^(a)	Mst. Type ^(b)	Data ^(c)	Comments ^(d)
Lee, 1968 ⁽¹³¹⁾	Critical ST	$\gamma_c = 29 \text{ mJ/m}^2$; no temp cited	Test liquids: water, glycerol, formamide, alcohols, and long-chain polyglycols.
Shafrin, 1975 ⁽²³⁷⁾	Critical ST	$\gamma_c = 32 \text{ mJ/m}^2$; 20°C	Test liquids not known.
Markgraf, 2005 ⁽⁶²⁾	Critical ST	$\gamma_c = 29\text{-}31 \text{ mJ/m}^2$; no temp cited	Test liquids not known.
Schonhorn, 1966 ⁽²³⁷⁾	Contact angle	$\theta_w^A = 108^\circ$; no temp cited	
Strobel, 1985 ⁽⁶⁸⁾	Contact angle	$\theta_w^A = 104^\circ$; no temp cited	Measured by sessile drop method.
Winters, 1985 ⁽¹⁸⁴⁾	Contact angle	$\theta_w^Y = 100^\circ$; no temp cited	
Kogoma, 1987 ⁽⁶⁶⁾	Contact angle	$\theta_w^Y = 105^\circ$; no temp cited	
Strobel, 1987 ⁽⁸⁴⁾	Contact angle	$\theta_w^A = 104^\circ$; no temp cited	
Marchant, 1988 ⁽¹²⁰⁾	Contact angle	$\theta_w^A = 95.9^\circ$; no temp cited	Oriented PP.
Dewez, 1991 ⁽⁷⁸⁾	Contact angle	$\theta_w^Y = 95^\circ$; no temp cited	
Inagaki, 1991 ⁽²⁴⁰⁾	Contact angle	$\theta_w^Y = 98^\circ$; no temp cited	
Occhiello, 1991 ⁽²⁰²⁾	Contact angle	$\theta_w^Y = 87.5^\circ$; no temp cited	
Occhiello, 1991 ⁽²⁰²⁾	Contact angle	$\theta_w^A = 95^\circ$, $\theta_w^R = 80^\circ$, $d\theta_w = 15^\circ$; no temp cited	
Sauer, 1991 ⁽²¹⁰⁾	Contact angle	$\theta_w^A = 116^\circ$; 25°C	Isotactic PP.
Bonnerup, 1993 ⁽⁷⁾	Contact angle	$\theta_w^Y = 89^\circ$; no temp cited	Washed with toluene and isopropanol, then dried overnight.
Good, 1993 ⁽¹⁹⁾	Contact angle	$\theta_w^A = 106^\circ$, $\theta_w^R = 86^\circ$, $d\theta_w = 20^\circ$; no temp cited	
Strobel, 1993 ⁽³⁾	Contact angle	$\theta_w^A = 117^\circ$, $\theta_w^R = 95^\circ$, $d\theta_w = 22^\circ$; 20°C	
Fukuzawa, 1994 ⁽¹¹³⁾	Contact angle	$\theta_w^Y = 95.6^\circ$; no temp cited	Contact angle measured after stabilizing for 15 secs.
Inagaki, 1996 ⁽⁸³⁾	Contact angle	$\theta_w^A = 99^\circ$; no temp cited	
Inagaki, 1996 ⁽⁸³⁾	Contact angle	$\theta_w^A = 117^\circ$; no temp cited	
Sarmadi, 1996 ⁽¹⁹⁸⁾	Contact angle	$\theta_w^Y = 98.5^\circ$; no temp cited	
Strobel, 1996 ⁽⁹⁵⁾	Contact angle	$\theta_w^A = 117^\circ$, $\theta_w^R = 95^\circ$, $d\theta_w = 22^\circ$; no temp cited	Measured by sessile drop method.
Della Volpe, 1998 ⁽¹⁴⁰⁾	Contact angle	$\theta_w^A = 108.7^\circ$, $\theta_w^R = 87.8^\circ$, $d\theta_w = 19.9^\circ$; no temp cited	
Angu, 2000 ⁽²²⁰⁾	Contact angle	$\theta_w^Y = 89.2^\circ$; no temp cited	Underwater captive bubble method, measured on concave tubular surface; technique A.
Angu, 2000 ⁽²²⁰⁾	Contact angle	$\theta_w^Y = 93.1^\circ$; no temp cited	Underwater captive bubble method, measured on concave tubular surface; technique B.
Cho, 2000 ⁽⁹⁹⁾	Contact angle	$\theta_w^Y = 93^\circ$; no temp cited	Measured by sessile drop method.
Johansson, 2000 ⁽¹⁰¹⁾	Contact angle	$\theta_w^A = 99^\circ$; no temp cited	Oriented PP.
Gotoh, 2004 ⁽⁹²⁾	Contact angle	$\theta_w^A = 110.4^\circ$; no temp cited	Measured by sessile drop method.
Gotoh, 2004 ⁽⁹²⁾	Contact angle	$\theta_w^A = 112^\circ$, $\theta_w^R = 90^\circ$, $d\theta_w = 22^\circ$; no temp cited	Measured by Wilhelmy plate method.

Kitazaki, 1972 ⁽¹⁹¹⁾	Contact angle	$\gamma_s = 29.8 \text{ mJ/m}^2$ ($\gamma_s^d = 29.8$, $\gamma_s^p = 0.0$); no temp cited	Various test liquids; original results split polar component into hydrogen- and non-hydrogen bonding parameters.
Brewis, 1981 ⁽²⁶¹⁾	Contact angle	$\gamma_s = 30.2 \text{ mJ/m}^2$ ($\gamma_s^d = 30.2$, $\gamma_s^p = 0.0$); no temp cited	Test liquids not known.
Marchant, 1988 ⁽¹²⁰⁾	Contact angle	$\gamma_s = 28.4 \text{ mJ/m}^2$ ($\gamma_s^d = 27.0$, $\gamma_s^p = 1.4$); no temp cited	Test liquids: water and diiodomethane; oriented PP.
Tsutsui, 1989 ⁽¹⁸⁸⁾	Contact angle	$\gamma_s = 28.7 \text{ mJ/m}^2$ ($\gamma_s^d = 23.4$, $\gamma_s^p = 5.3$); no temp cited	Test liquids: water and diiodomethane; oriented PP. Test liquids: water and diiodomethane.
van Oss, 1989 ⁽²²⁾	Contact angle	$\gamma_s = 25.7 \text{ mJ/m}^2$ ($\gamma_s^{LW} = 25.7$, $\gamma_s^{AB} = 0.0$, $\gamma_s^+ = 0.0 \text{ mJ/m}^2$, $\gamma_s^- = 0.0$); 20°C	Test liquids: water, alpha-bromonaphthalene, diiodomethane, formamide, and glycerin; acid-base analysis.
Occhiello, 1991 ⁽²⁰²⁾	Contact angle	$\gamma_s = 30.3 \text{ mJ/m}^2$ ($\gamma_s^d = 26.7$, $\gamma_s^p = 3.6$); no temp cited	Test liquids: water and diiodomethane.
Sauer, 1991 ⁽²¹⁰⁾	Contact angle	$\gamma_s = 29.0 \text{ mJ/m}^2$; 25°C	Test liquids not known; from advancing contact angle. Isotactic PP.
Bonnerup, 1993 ⁽⁷⁾	Contact angle	$\gamma_s = 36.6 \text{ mJ/m}^2$ ($\gamma_s^d = 30.1$, $\gamma_s^p = 6.5$); no temp cited	Test liquids: water and diiodomethane; washed with toluene and isopropanol, then dried overnight.
Good, 1993 ⁽¹⁹⁾	Contact angle	$\gamma_s = 32.6 \text{ mJ/m}^2$ ($\gamma_s^{LW} = 32.6$, $\gamma_s^{AB} = 0.0$, $\gamma_s^+ = 0.0$, $\gamma_s^- = 0.0$); no temp cited	Test liquids: water, glycerol, diiodomethane; acid-base analysis based on advancing contact angle.
Good, 1993 ⁽¹⁹⁾	Contact angle	$\gamma_s = 38.1 \text{ mJ/m}^2$ ($\gamma_s^{LW} = 35.9$, $\gamma_s^{AB} = 2.2$, $\gamma_s^+ = 1.3$, $\gamma_s^- = 0.9$); no temp cited	Test liquids: water, glycerol, diiodomethane; acid-base analysis based on receding contact angle.
Fukuzawa, 1994 ⁽¹¹³⁾	Contact angle	$\gamma_s = 31.2 \text{ mJ/m}^2$ ($\gamma_s^{LW} = 31.1$, $\gamma_s^{AB} = 0.05$, $\gamma_s^+ = 0.0$, $\gamma_s^- = 2.1$); no temp cited	Test liquids: water, formamide, and diiodomethane; acid-base analysis, calculated per Good and Van Oss ⁽⁸⁶⁾ . Contact angles
Fukuzawa, 1994 ⁽¹¹³⁾	Contact angle	$\gamma_s = 32.2 \text{ mJ/m}^2$; no temp cited	measured after stabilizing for 15 secs. Test liquids: water, formamide, and diiodomethane; acid-base analysis calculated by arithmetic and geometric means.
Inagaki, 1996 ⁽⁸³⁾	Contact angle	$\gamma_s = 27.2 \text{ mJ/m}^2$ ($\gamma_s^d = 25.9$, $\gamma_s^p = 1.3$); no temp cited	Test liquids: water, glycerol, formamide, diiodomethane, and tricresyl phosphate; based on advancing contact angles.
Sarmadi, 1996 ⁽¹⁹⁸⁾	Contact angle	$\gamma_s = 30.8 \text{ mJ/m}^2$ ($\gamma_s^d = 30.6$, $\gamma_s^p = 0.2$); no temp cited	Test liquids not known.
Morra, 1999 ⁽¹³⁴⁾	Contact angle	$\gamma_s = 28.3 \text{ mJ/m}^2$ ($\gamma_s^{LW} = 28.3$, $\gamma_s^{AB} = 0.0$, $\gamma_s^+ = 0.0$, $\gamma_s^- = 0.0$); no temp cited	Test liquids not known; acid-base analysis based on reference values for water of $\gamma^+ = 48.5 \text{ mJ/m}^2$ and $\gamma^- = 11.2 \text{ mJ/m}^2$.
Della Volpe, 2000 ⁽¹⁶³⁾	Contact angle	$\gamma_s = 31.9 \text{ mJ/m}^2$; no temp cited	Re-calculated from data produced by Della Volpe, 1998 ⁽¹⁴⁰⁾ .
Grundke, 2000 ⁽²⁵⁶⁾	Contact angle	$\gamma_s = 30.4 \text{ mJ/m}^2$; no temp cited	
Della Volpe, 2002 ⁽¹⁴¹⁾	Contact angle	$\gamma_s = 31.3 \text{ mJ/m}^2$ ($\gamma_s^{LW} = 31.3$, $\gamma_s^{AB} = 0.08$, $\gamma_s^+ = 0.09$, $\gamma_s^- = 0.02$); no temp cited	Various test liquids; acid-base analysis based on reference values for water of $\gamma^+ = 48.5 \text{ mJ/m}^2$ and $\gamma^- = 11.2 \text{ mJ/m}^2$; from advancing contact angles.
Della Volpe, 2002 ⁽¹⁴¹⁾	Contact angle	$\gamma_s = 36.3 \text{ mJ/m}^2$ ($\gamma_s^{LW} = 36.3$, $\gamma_s^{AB} = 0.0$, $\gamma_s^+ = 0.0$, $\gamma_s^- = 0.0$); no temp cited	Various test liquids; acid-base analysis based on reference values for water of $\gamma^+ = 48.5 \text{ mJ/m}^2$ and $\gamma^- = 11.2 \text{ mJ/m}^2$; from equilibrium (average of advancing and retreating) contact angles.
Berta, 2003 ⁽²⁶²⁾	Contact angle	$\gamma_s = 30.7 \text{ mJ/m}^2$ ($\gamma_s^d = 24.9$, $\gamma_s^p = 5.8$);	Test liquids not known; calculated by harmonic mean

Berta, 2003 ⁽²⁶²⁾	Contact angle	no temp cited $\gamma_s = 28.6 \text{ mJ/m}^2$ ($\gamma_s^d = 26.5$, $\gamma_s^p = 2.1$); no temp cited	equation. Test liquids not known; by geometric mean equation.
Gotoh, 2004 ⁽⁹²⁾	Contact angle	$\gamma_s = 32.8 \text{ mJ/m}^2$ ($\gamma_s^{LW} = 32.6$, $\gamma_s^{AB} = 0.2$, $\gamma_s^+ = 0.1$, $\gamma_s^- = 0.1$); no temp cited	Test liquids: water, diiodomethane, and ethylene glycol; by sessile drop method; acid-base analysis.
Roe, 1968 ⁽³²⁾	From polymer melt	$\gamma_s = 29.4 \text{ mJ/m}^2$; 20°C	Direct measurement of polymer melt extrapolated to 20°C. Atactic PP.
Schonhorn, 1965 ⁽¹⁹⁴⁾	From polymer melt	$\gamma_s = 28.3 \text{ mJ/m}^2$; 20°C	Direct measurement of polymer melt extrapolated to 20°C. Isotactic PP, $M_n = 3000$.
Oda, 1968 ⁽²⁰⁷⁾	From polymer melt	$\gamma_s = 30.1 \text{ mJ/m}^2$ ($\gamma_s^d = 29.5$, $\gamma_s^p = 0.6$); 20°C	Direct measurement of polymer melt extrapolated to 20°C; polarity calculated from interfacial tension with PE by harmonic mean. Mixture of atactic and isotactic PP.
Lee, 1968 ⁽¹³¹⁾	Calculated	$\gamma_s = 28 \text{ mJ/m}^2$; no temp cited	Calculated from glass temperature of 253K.
Wu, 1968 ⁽¹⁸²⁾	Calculated	$\gamma_s = 27 \text{ mJ/m}^2$; 20°C	Calculated from molecular constitution.
Sewell, 1971 ⁽¹⁹³⁾	Calculated	$\gamma_s = 27.8 \text{ mJ/m}^2$; no temp cited	Calculated from parachor and cohesive energy.
Sewell, 1971 ⁽¹⁹³⁾	Calculated	$\gamma_s = 23.0 \text{ mJ/m}^2$; no temp cited	Calculated by least squares from cohesive energy and molar volume.
Van Krevelen, 1976 ⁽⁸⁵⁾	Calculated	$\gamma_s = 32.5 \text{ mJ/m}^2$; no temp cited	Calculated from parachor parameter.
Wu, 1982 ⁽¹⁸⁾	Calculated	$\gamma_s = 28.5 \text{ mJ/m}^2$; 20°C	Calculated from cohesive energy density and solubility parameters.
Van Ness, 1992 ⁽¹⁸⁶⁾	Calculated	$\gamma_s = 30.9 \text{ mJ/m}^2$; 20°C	Calculated molten surface tension value, extrapolated to 20°C.
Grundke, 2000 ⁽²⁵⁶⁾	Other	$\gamma_s = 30.2 \text{ mJ/m}^2$; no temp cited	Determined by capillary penetration into packed polymer powder.