

Phase III Sample – F2 Refinery Product

F2 is a refinery product that is a viscous liquid at room temperature. In Phase III, the F2 sample is available. Researchers can treat F2 by vacuum distilling it to produce a glassy solid. Both the original F2 sample and the F2 vacuum distilled sample will require further treatment before spinning. Our understanding of carbon fibre feedstocks indicates that both are a potentially good starting point for carbon fibre and worth exploring.

Analytical Properties

Property	F2 Sample ¹	Unit
Available in Phase III	Yes	
State at room temperature	Viscous liquid	
Carbon	82.3	% mass
Hydrogen	9.7	% mass
Nitrogen	0.6	% mass
Sulfur	5.7	% mass
Oxygen	1.6	% mass
Molybdenum	6	ppm
Nickel	101	ppm
Sodium	10	ppm
Vanadium	273	ppm
Zinc	29	ppm
Asphaltene (pentane insoluble)	21.5	% weight
Asphaltene (heptane insoluble)	12.2	% weight
Ash Content	0	% weight
Micro Carbon Residue	11.6	% mass
Toluene Insoluble	0.1	% weight
Quinoline Insoluble	0	% weight
Softening Point	48.6	°C
5% cut point	428	°C
10% cut point	460	°C
Fraction <524 °C	23	% weight
Fraction + 720 °C	32	% weight

*Properties to be measured by CFGC Phase III teams

¹In Phase II this sample was L1

Sample F2 Preparation

Sample origin	Mainly Cold Lake bitumen
Processing steps from raw feed	F2 Sample: atmospheric distillation and vacuum distillation to remove diluent and gas oil fractions
Maximum Temperature:	Up to 400°C for times of a few minutes
References	Gray, M.R. Upgrading of Oilsands Bitumen, University of Alberta Press, 2015, Chapter 8; Hsu, C.S., Robinson, P.R. Springer Handbook of Petroleum Technology, 2017, Chapter 16. Keesom, W., Gieseeman, J. Bitumen Partial Upgrading 2018 Whitepaper AM0401A, Alberta Innovates 2018, https://albertainnovates.ca/app/uploads/2018/07/Bitumen-Partial-Upgrading-March-2018-Whitepaper-2433-Jacobs-Consultancy-FINAL_04July.pdf

Sample F2 Treatment

Sample F2 from the refinery requires further treatment to be a potential feed for carbon fibre. Additional heat or chemical treatment may be required. There are numerous options and pathways for treating F2 to potentially make a carbon fibre feedstock, including vacuum distilling it.

Sample F2 Commerciality

Sample F2 is a commercial product and will be a commercial product in 2027 and beyond.

For F2 vacuum distilled residue, a new commercial distillation setup would need to be built.