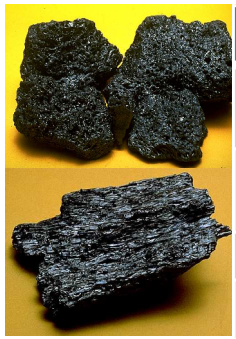
Wood Sustainable Pathways

Targeting Coke Type

- Fuel grade coker units can be revamped to produce **high value Anode and Needle coke**
- Anode coke is a high value coke, used in the manufacture of aluminum and produced with feedstocks that are paraffinic and low in sulfur, asphaltenes and metals (V)
- Needle coke is a premium grade of coke produced **by delayed coking of aromatic tars**
- Needle coke is a key component in Li-ion battery for EV and other high-performance devices



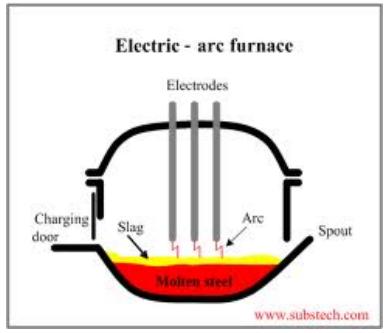
Variable	Fuel Coke	Anode Coke	Needle Coke
Temperature, °F (°C)	910 – 930 (488 – 498)	925 – 950 (496 – 510)	940 – 950 (504 – 510)
Pressure, psig (kg/cm2-g)	15 (1.05)	18 – 60 (1.3 – 4.2)	60 – 120 (4.2 – 8.4)
Recycle	0 – 5%	0 – 50%	60 – 150%
Coking Time, hours	9 –18	24	32 – 36

What is Needle Coke?

- A carbonaceous material with defined, anisotropic structure
- The term "anisotropic" describes a material having a structure whose property values (e.g., coefficient of thermal expansion and electrical resistivity), in one direction differ from those measurements taken at 90 degrees to the original measurements.
- When crushed, the coke particles are shaped like needles as a result of the crystalline structure.

Usage

- manufacture of graphite electrodes for use in the steel industry's electric arc furnaces (EAF).
- Recent uses include production of synthetic graphite for other uses – such as anode material for lithium-ion batteries used in electric vehicles.
- Electrodes for EDLC (Electric Double Layer Capacitors



Needle Coke Grades

- Grade classifications: regular, premium, and super premium based on:
  - coefficient of thermal expansion (CTE) – lower the better
  - electrical resistivity – lower the better
  - coke hardness
  - sulfur and nitrogen content

SYDEC℠ *Volt*

Anode & Needle Coke

Needle Coke Feedstock

- Typical Feeds include Decant oil Ethylene cracker residue (ECR or py-tar), Coal tar pitch (CTP), Lube extracts

- Type: Highly aromatic
- Aromatics: > 75%
- Sulfur: <0.4 – 0.5 wt.%
- Nitrogen: <700 – 1,000 ppmw
- Quinoline Insolubles (QI): <0.1 wt.% for UHP needle coke

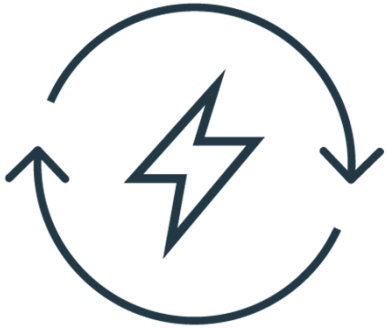
wood.

Summary

Needle coke is a unique product that requires fundamental understanding of:

- Feedstock characteristics
- Operating conditions

Repurposing an existing fuel grade coker to produce needle coke is possible but key equipment and design conditions have to be checked.



For more information contact
coking@woodplc.com

Wood has relevant experience to support your needle coke project:

- Feasibility study
- Feedstock screening
  - In-house methods
  - Tube coking
- Pilot plant testing and coke analysis
  - Confirm configuration, yields, & product properties
  - Coke production runs
  - Calcination and CTE testing

wood.