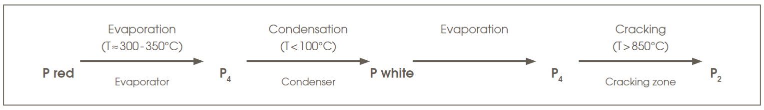
Valved Cracker Cell for Phosphorus - KPC

- **More than 120 in operation**
- **Three-zone temperature concept**
- **Fast and precise control over phosphorus flux**
- **100% leak tight all metal metering valve«**
- **Zero- burst » patented design**
- **Rugged and reliable**



Product introduction

The Riber valved cracker for phosphorus is designed to provide a safe, simple and highly effective phosphorus source. This multi-zone cell is based upon a patented process to first generate white phosphorus from a commercially available red phosphorus charge and then use this high vapor pressure element to produce very stable P2 fluxes. These fluxes can be quickly and precisely adjusted with very good repeatability, enabling growth of P-containing layers, such as InP, GaInP, GaInAsP…

The valved cracker consists of three main parts: the reservoir, the isolation valve and the cracker stage. The reservoir is made of two sub-assemblies, the evaporator and the condensor.

Working principle

The evaporator is placed inside the condensor and receives the red phosphorus primary loaded charge. For easy loading, the evaporator heated crucible is mounted on an independent base flange. After loading, the red phosphorus is heated to an evaporation temperature to produce P4 that will condense into white phosphorus onto the condenser walls.

The condensor surrounds the red phosphorus evaporator and is connected to the flux valve. An isolation valve vents and pumps down the condensor during re-loading operations. White phosphorus is re-evaporated at a rate dependent upon the condenser temperature, typically 60/100°C, thanks to a thermostatic enclosure allowing independent temperature control of the condensor between 40 and 120°C. The enclosure is heated with a fan assisted forced air circulation and temperature is monitored by a controller.

An all-metal valve is placed between the condensor and the cracker stage. It is fully independent and can easily be serviced or replaced. The micrometer driving mechanism enables fine adjustment and complete interruption of the phosphorus flux to the cracker. The valve is fully leak tight in closed position, enabling cell reloading without venting. The valve is externally heated by a jacket to prevent white phosphorus condensation onto the valve mechanism. KPC 6000 features an additional pneumatic valve dedicated for reloading operations, with very low leak rate

The cracker stage is inserted inside the growth chamber and is connected to the valve. A high conductance transit tube allows the transfer of P4 molecules to the cracking zone. The cracker stage design allows an efficient dissociation of the P4 molecules to P2. The cracker is heated by a flat Ta filament. A WRe thermocouple is used to monitor the cracker stage temperature.

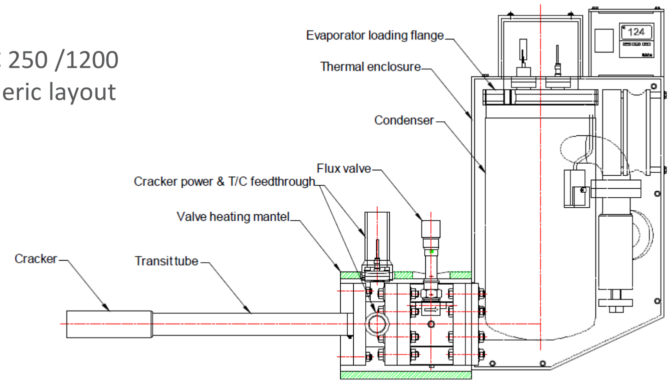
An independent and optional water panel can be provided around the cracker to limit the heat load in the growth chamber.

<u>**CAUTION**</u>

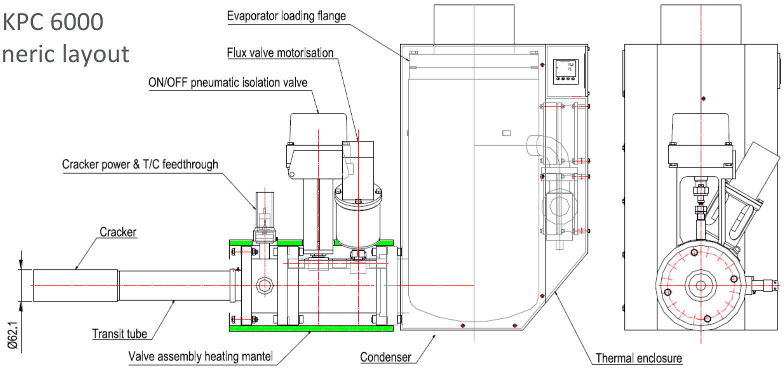
<u>Please not that the use of Phosphorus in a MBE reactor requires a phosphorus trap accessory in order to safely use and maintain the reactor, due to phosphorus fire and toxicity hazards. Please consult accessory section or consult Riber for detailed information</u>

Layout

KPC 250 /1200
generic layout



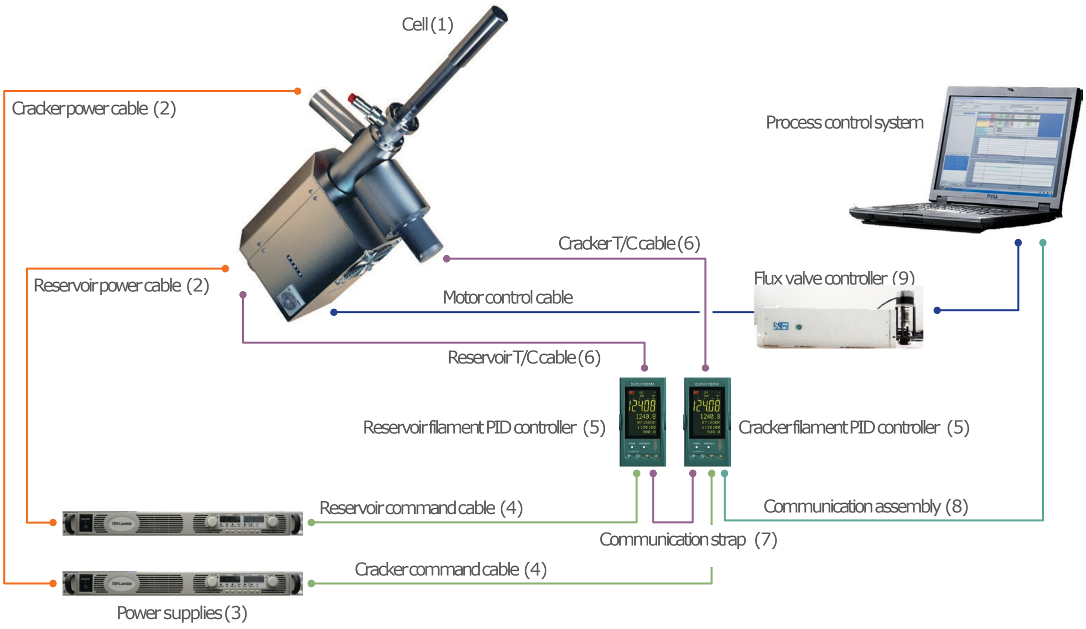
KPC 6000
generic layout



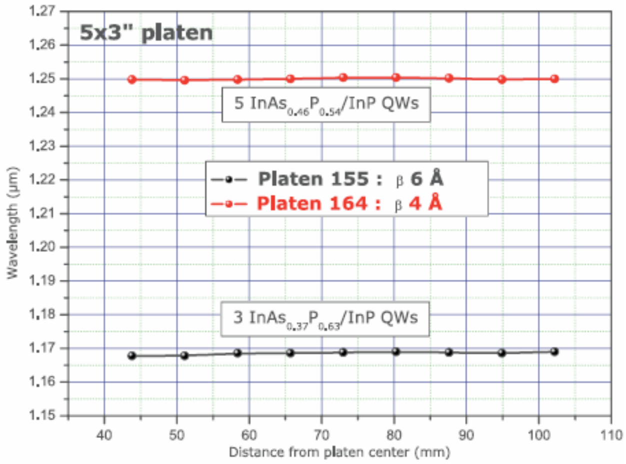
Specifications

Source model	KPC250	KPC1200	KPC6000
Filament	High purity Ta		
Heating filaments	Wire	Wire (evaporator) + Flat foil (cracker)	
Crucible / valve material	Al203/Stainless steel		
Useful capacity (max load dimensions)	250 cc	1200 cc	6000 cc
Mounting flange (min)	CF 40 (2" 3/4)	CF 63 (4.5")	CF100 (6")
Valve characteristics			
Valve	Single		Double
Heating mantle – 240 VAC	50 W	180 W	350 W
Open conductance	0.3 l/s		0.36 l/s
Close conductance	<5.10-10 l/s		
Valve actuator	Micrometer valve	Micrometer rotating thimble	
Typical operating temp	80°C		
Max outgassing temperature	150°C heater powered, 250°C heater unpowered, 350°C heater dismounted		
Cracker Characteristics			
Max outgassing temperature	1300°C		
Temperature range/ Operating temperature	400-1200°C / 850-900°C		
Power consumption	500W max	1050 W max	1500 W max
Thermocouple connector	C-Type		
Temperature stability	+/-0.5°C		
Reservoir Characteristics			
Loading Port	CF63	CF100	CF200
Evaporator max outgassing temperature (empty)	550°C		
Evaporator typical operating temperature	350°C		
Evaporator max power consumption	60W max	240W max	300 W max
Evaporator thermocouple connector	C-type		
Condenser max temperature	70°C	120°C	
Condenser typical operating temperature	50°C	60°C	
Condenser Heater	Thermostatic enclosure / 240 VAC / 200 W (KPC250) - 400 W (KPC 1200/6000)		
Temperature stability	+/-0.5°C		

Component interfacing



Results



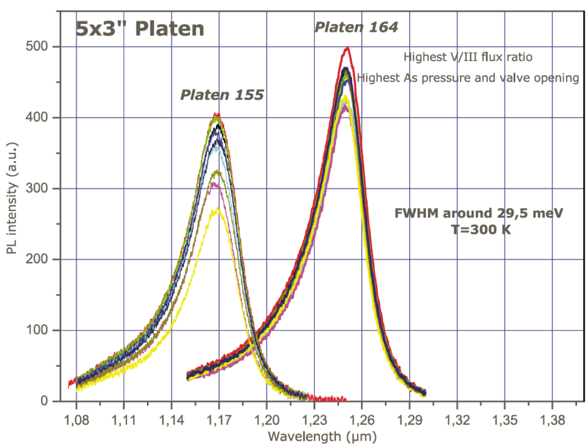
Outstanding InAsxP1-x Compositional Uniformity

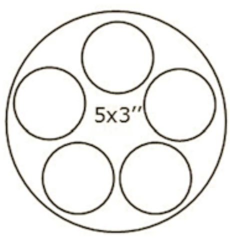
Through the growth of InAsP/InP multi-quantum wells, Riber application laboratory demonstrates the excellent uniformity profile of the KPC1200 & VAC 3000

Photoluminescence spectra of InAsP/InP multi quantum wells.

Composition of the InAsP quantum well is highly dependent on the As/P flux ratio and on the substrate temperature over the platen.

±4Å for the optimal V/III ratio, corresponding to a As/P composition variation of ± 0.05%





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