# Devices design in solar-blind diamond photodetectors

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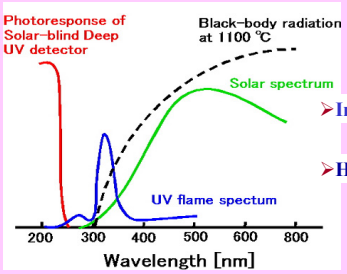
## Why Diamond DUV Detectors




- Intrinsic solar-blind
- High intrinsic resistivity

## Motivation: High-performance DUV Detectors

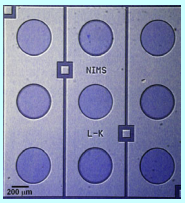
- High DUV/vis discrimination ratio
- High DUV sensitivity
- High SNR
- Fast response

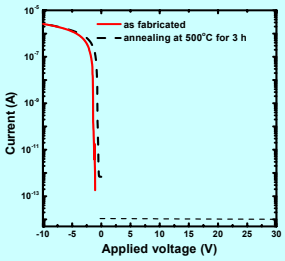
→ Proper device design necessary

## Diamond Thin film Growth and Devices Fabrication

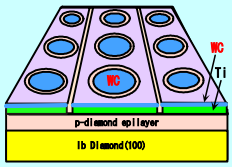
- MPCVD growth on Ib (100) diamond substrate
- Unintentional & intentional boron doping.
- Ohmic contact: annealed Ti (40nm)/WC(30nm)
  Schottky contact: WC

## Thermally-stable Schottky Photodiode



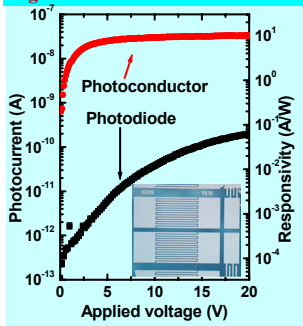



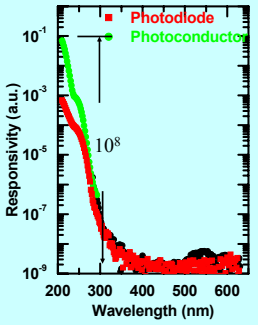

Dark I-V characteristics




- Leakage current $<10^{-14}$A upon 500°C annealing.
- Rectifying ratio ~ $10^8$
- WC: thermally stable Schottky contact

## High Solar-blind Ratio MSM Photodetectors

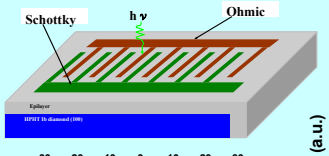


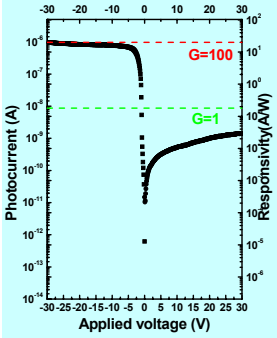



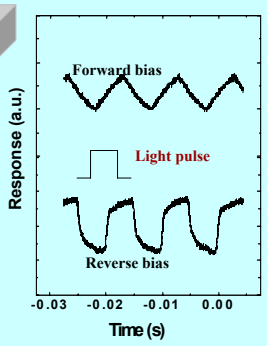

- Responsivity: 6 A/W@3 V for 220 nm light
- Response time < 0.3 s

Spectral response showing a solar-blind ratio up to $10^8$

## A Novel Type Schottky Photodetetor for Multi-function



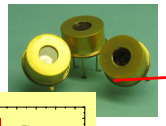



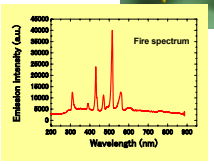

Fast response time at reverse biases

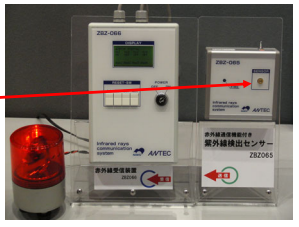
- High sensitivity at forward biases.
- Low noise
- High SNR

- Two-mode operation: combining photodiode and photoconductor, into one.
- Reducing the substrate effect.
- High quantum efficiency.

## Proto-type Flame Sensor Using Diamond





## Summary

- ✓Developing the thermally stable WC-based contacts to diamond.
- ✓Designing the metal-semiconductor-metal photodetector with a very high solar-blind ratio
- ✓Proposing a Schottky photodiode combing the functions of photoconductor and photodiode.
- ✓Applying to flame sensing