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PHASE-SENSITIVE SURFACE PLASMON RESONANCE SENSOR BASED ON INTERFEROMETRIC CONFIGURATION

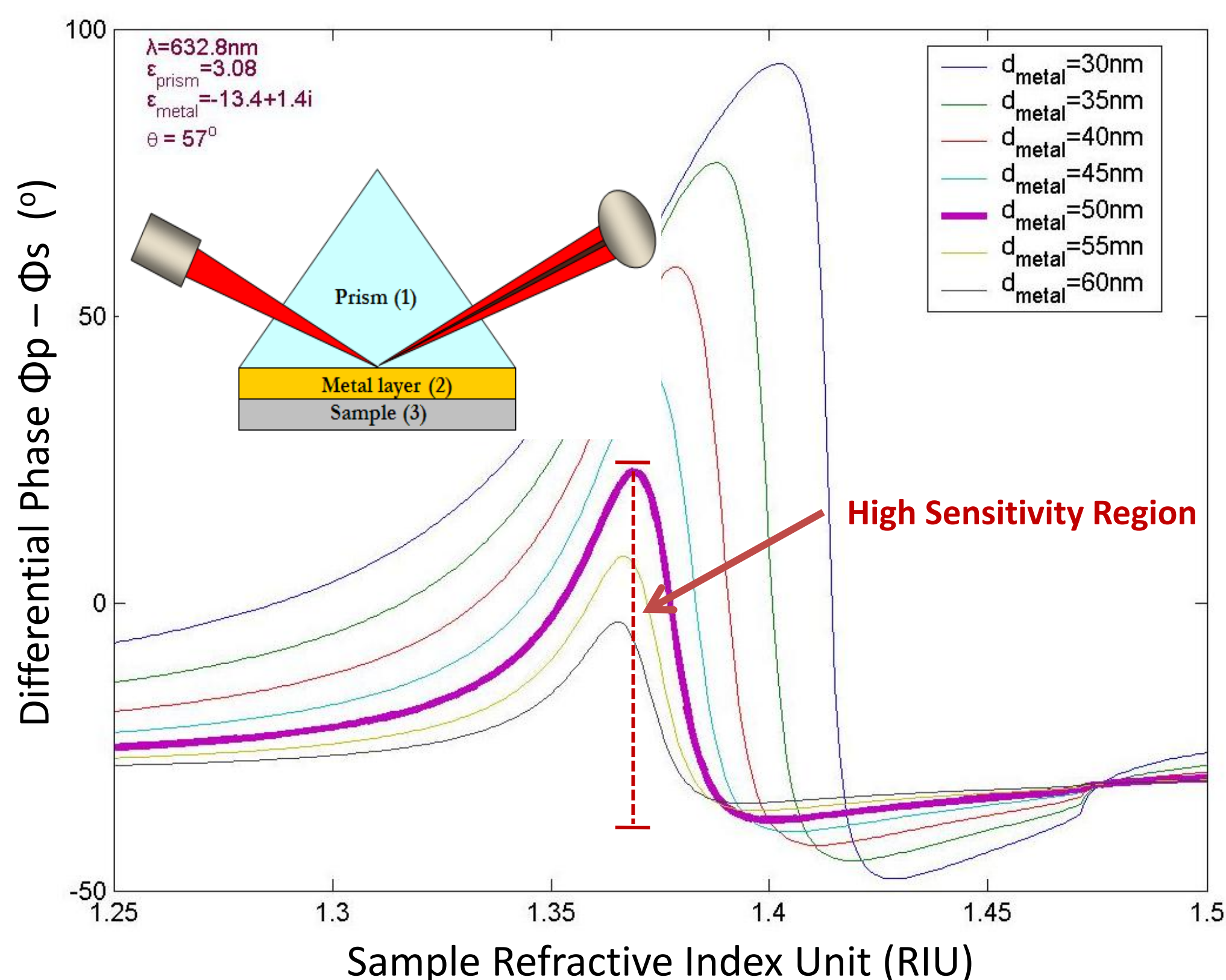
Background

Surface plasmon waves are quantized harmonic oscillatory motion of electrons at the surface. The criteria for excitation of surface plasmon resonance (SPR) are: the incident wave must be matched in angular frequency and momentum with that of the surface plasmon.

Novelties & Applications

- ❖ **Simplified multi-reflection model** for surface plasmon
- ❖ High sensitivity by **phase detection**
- ❖ **Noise suppression** using interferometric configuration
- ❖ Demonstrated refractive index measurement for **CoCl₂**
- ❖ Potential application in real time bio-molecular interactions
- ❖ Potentially useful for biosensing and bioimaging

Simulation Results



Discussions

- ❖ S-polarized light serves as a reference
- ❖ Interferometer for phase detection
- ❖ Differential phase:

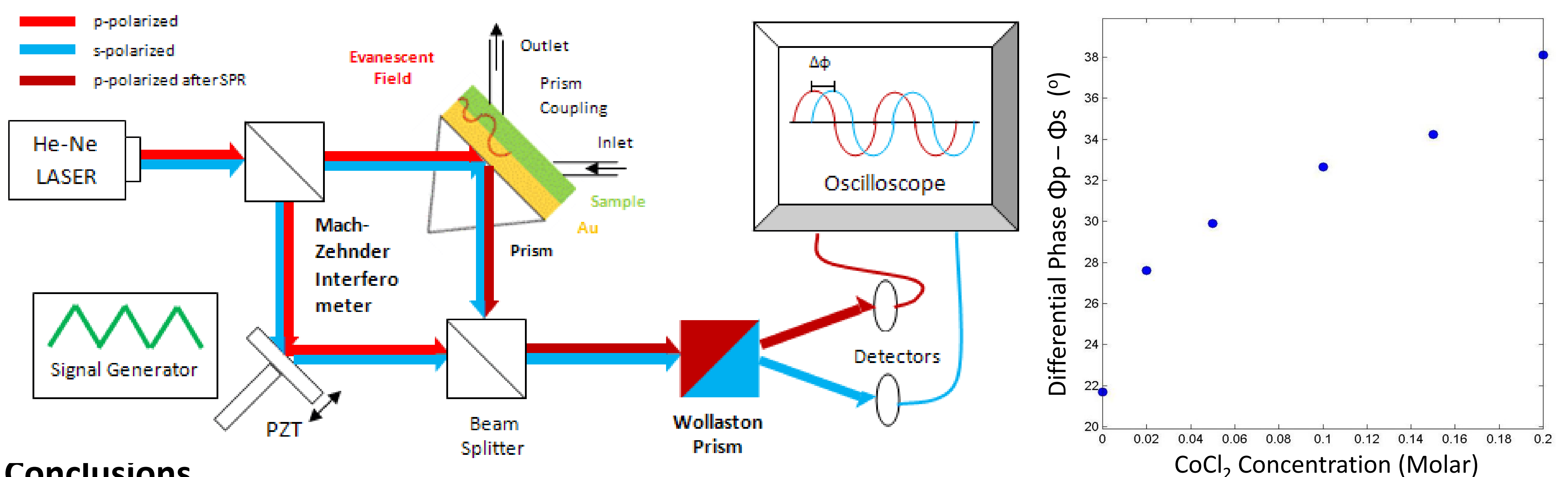
$$r_{p(s)} = \frac{r_{12} + r_{23} \exp(2ik_{z2}d)}{1 + r_{12}r_{23} \exp(2ik_{z2}d)}$$

$$\Delta\phi = \arg(r_p) - \arg(r_s)$$

r_{12} : reflectivity of prism-metal interface
 r_{23} : reflectivity of metal-sample interface
 k_{z2} : wave number vector of the transmitted light in the metal layer

- ❖ Integration with microfluidics for real time detection
- ❖ Simultaneous detection of both polarizations
- ❖ Resolution (theoretical): 4.1×10^{-4} RIU/degree
- ❖ Resolution (experimental): 3.1×10^{-2} Molar/degree

Experimental Results



Conclusions

- ❖ High phase detection sensitivity is obtained theoretically and demonstrated in the experiment.
- ❖ A linear relationship ($R^2=0.8994$) is observed for differential phase change vs. sample concentrations.