























**Table 2. Calculated converted power densities**

	<b>Dielectric filled cavity</b> <i>Hemispherical</i>	<b>Air filled cavity</b> <i>Hemispherical</i>	% change
PVC Converted Power Density, $P_D$ ( $T = 1300$ K, $\lambda_g = 2.22 \mu\text{m}$ )	2.43 W/cm <sup>2</sup>	1.82 W/cm <sup>2</sup>	33.5%

Table 2 shows the increased converted power density from the PVC using the dielectric filled MPhC as compared to the air filled MPhC. The temperature of the emitter is again chosen to be 1300 K which corresponds to both the bandgap of the PVC ( $E_g = 2.22 \text{ eV}$  or  $\lambda_g = 2.22 \mu\text{m}$ ) and the cut-off wavelength of the emitter ( $\lambda_c = 2.22 \mu\text{m}$ ).

## 5. Conclusion

We demonstrate the theory and simulation of the dielectric filled MPhC for wide angle absorption/emission properties for the application of TPV systems. We have shown that the dielectric in the cavities reduces the period of the MPhC while maintaining a constant cut-off wavelength  $\lambda_c$ , thus reducing undesired diffraction losses at oblique angles. By eliminating diffraction channels at oblique angles, the coupling of the incident light to the cavity modes is significantly increased. As a result, the absorption/emission of dielectric filled MPhC at oblique angles is significantly improved when compared to air filled cavities. We calculate that the minimum ratio of incident wavelength to period ( $\lambda/a$ ) need only be a factor of 2 to avoid diffraction losses up to  $90^\circ$  for the cut-off wavelength. A STPV analysis using the dielectric filled cavities is performed, which shows a 7% and 15.7% improvement for the absorber and emitter efficiency, respectively, in comparison with the air filled cavities. The converted output power density is also increased by 33.5% for the dielectric filled MPhC design.

## Acknowledgments

This material is based on the work supported as part of the Solid State Solar-Thermal Energy Conversion Center (S3TEC), an Energy Frontier Research Center funded by the U.S. Department of Energy, Office of Science, Office of Basic Energy Sciences under award DE-SC0001299/DE-FG02-09ER46577.