

Table 3. Electrical conductivity and activation energy of ordinary chondrite

Samples	Conductivity at 723 K (S/m)	Conductivity at 1333 K (S/m)	Activation energy (eV)
Burdett	7.08×10^{-8}	1.99×10^{-4}	1.086
Dalhart	1.25×10^{-8}	1.25×10^{-4}	1.27
Faucett	1.02×10^{-9}	1.58×10^{-4}	1.65
Wellmann	1.08×10^{-10}	5.01×10^{-6}	1.57

which affect the thermal properties of the ordinary chondrites¹².

Figure 1 shows the temperature dependence of the electrical conductivity of four ordinary chondrites as a function of temperature (723 to 1333 K). At room temperature the values of the conductivity are too low and could not be measured with the existing measuring instruments. The upper limit of the temperature of the present investigation was limited to 1333 K, due to an instrumental problem. The contact was made only by applying the stress on the platinum electrical leads. The temperature dependence of the dc conductivity shows the Arrhenius behaviour with single activation energy over the temperature range of the investigations (723 to 1333 K). The activation energy was calculated for all the chondrite and the values are listed in Table 3. The values of activation energy for electronic conduction are found to vary from 1.086 eV for Burdett sample to 1.65 eV for Faucett sample. It is interesting to note that the value of the zero pressure activation energy of the studied ordinary chondrites is found to be in very close

agreement with that of San Carlos olivine 1.5 eV, indicating the olivine-rich nature of the ordinary chondrite, which is consistent with the chemical composition study. The single activation energy of all the samples reveals that there is no change of conductivity mechanism in the temperature range of investigations (723 to 1333 K) and also the absence of any hydrous or other volatile components in these ordinary chondrite samples.

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A novel ($8\pi + 8\pi$) cycloaddition of benzocondensed iminoketenes

Both concerted and nonconcerted cycloaddition reactions of various orders involving reactive intermediates such as ketenes are well known^{1–4}. However, *in situ* generation of a diene or dienophile is of comparatively recent interest^{5–10}. It is interesting to note that sulphinamide anhydride will also generate *in situ* diene, which on Diels–Alder reaction should yield various types of heterocycles¹¹.

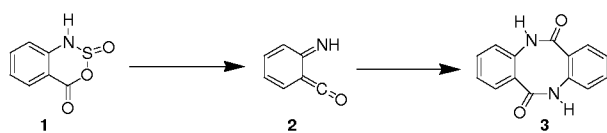
Although orbital symmetry-controlled ($8\pi + 8\pi$) cycloadditions are forbidden, few examples of this type were reported in the literature^{12,13}. When anthranilic

acid is treated with thionyl chloride, the corresponding sulphinamide anhydride is formed. Sulphinamide anhydride **1** gradually decomposes to iminoketene **2**, which is already reported in the literature^{14–17}. It has been found that in the absence of dienophile, sulphinamide anhydride decomposes to iminoketene **2**, which then undergoes ($8\pi + 8\pi$) cycloaddition forming dibenzo-[c,g]-[1,5]diazocene-1,5-dione **3** (Scheme 1).

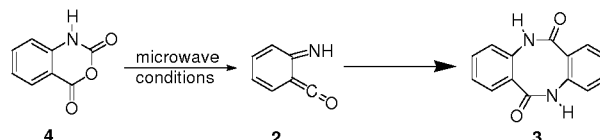
Compound **3** is unknown and identified by spectroscopic data and alternate method of synthesis¹⁸. It seems that the

reaction is a nonconcerted one, as the intermediate **2** dimerizes to form **3**. An analogous compound isatoic anhydride **4**, gave the same dimer **3** under microwave conditions¹⁸ (Scheme 2).

Sulphinamide anhydride (667.8 mg, 3.64 mmol) in dry benzene (20 ml) was left overnight. Excess solvent was removed by vacuum distillation and the residue was dissolved in CHCl_3 (20 ml) which was washed with 10% NaHCO_3 (3×10 ml), water (3×10 ml), dried over anhydrous MgSO_4 and chromatographed over silica gel (60–120 mesh) using



Scheme 1.



Scheme 2.

50% petroleum ether: C₆H₆ as solvent to yield a lemon yellow product (350 mg, 1.47 mmol, 81% yield) **3** with m.p. 166°C. The structure of the product was confirmed by spectral data.

Spectral data for **3**: IR (KBr): 3450.72 (NH-stretching), 3313.82, 1751.32 cm⁻¹ (CO stretching), 1626.83, 1552.18, 1477.53, 1315.59, 1240.95, 1172.38, 1054.21, 774.094, 680.724 cm⁻¹; ¹HNMR (CDCl₃): δ 8.22 (*d*, *J* = 9.7 Hz, 1H), 8.16 (*d*, *J* = 9.7 Hz, 1H), 7.79 (*t*, 1H), 7.58 (*d*, 1H), 7.47 (*t*, 1H), 7.27 (*d*, 1H), 6.76 (*t*, 2H), 4.76 (*s*, 2H, D₂O exchangeable); MS: *m/z* 238 (M⁺, 100%), 120 (30%), 119 (6%), 92 (16.2%), 65 (8%). Anal. calc. for C₁₄H₁₀N₂O₂: C, 70.59; H, 4.20; N, 11.76; O, 13.45%. Found: C, 70.57; H, 4.21; N, 11.77; O, 13.45%.

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Release of berberine and its crystallization in liquid medium of cell suspension cultures of *Cosciniium fenestratum* (Gaertn.) Colebr.

Cosciniium fenestratum (Gaertn.) Colebr., belonging to the family Menispermaceae, is a critically endangered dioecious medicinal liana found in Western Ghats, India¹ (Figure 1). It takes at least 15 years for the plant to flower and fruit. Stem and root of this plant are used as crude drugs, for which the plant is destructively collected from the forests, even before flowering and fruiting, resulting in its dwindling population. The active principle of this plant was identified as berberine^{2,3} (C₂₀H₁₈NO₄Cl), an

isoquinoline alkaloid having numerous biological activities⁴. Berberine is present in both vegetative and reproductive parts, indicating that berberine is synthesized in every part of the plant (young root = 0.15%, young stem = 0.10%, petiole = 0.11%, leaf lamina = 0.037%, male flower = 0.02%, female flower = 0.026%, fruit = 0.001%, older part of root (3.1 cm diameter) = 1.65% and older part of stem (6.2 cm diameter) = 1.775% of dry wt., unpublished data). Berberine-producing callus and cell suspension cultures were

established in this plant from petiole segments⁵. A protocol for obtaining callus and cell suspension cultures from leaf segments has also been established⁶. The aim of the present work was to analyse intracellular berberine and berberine released into the liquid medium in different combinations and concentrations of plant growth regulators.

Callus cultures were established from green leaf segments cultured under dark in Woody Plant Medium⁷ (WPM) supplemented with 2 mg/l 2,4-dichlorophen-